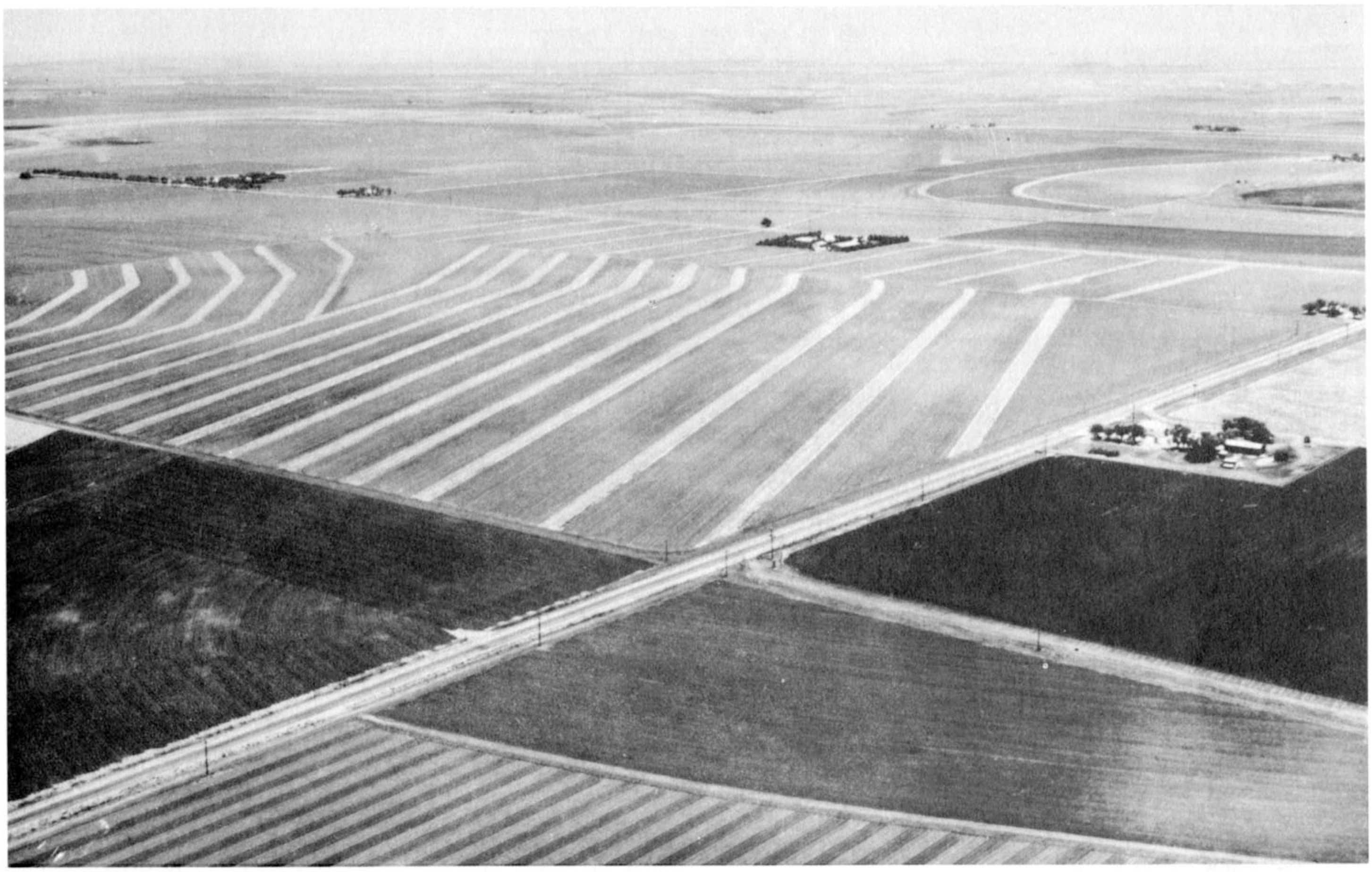
SOIL SURVEY OF

Garza County, Texas



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1960-65. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1965. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Garza Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Garza County are shown on the detailed map at the back of this survey. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It shows the page where each soil is described and the page for the capability unit and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

<u>Farmers and those who work with farmers</u> can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and range sites.

<u>Game managers, sportsmen, and others</u> can find information about soils and wildlife in the section "Management of the Soils for Wildlife."

<u>Ranchers and others</u> can find, under "Management of the Soils for Rangeland," groupings of the soils according to their suitability for range and also the names of many of the plants that grow on each range site.

<u>Engineers and builders</u> can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

<u>Scientists and others</u> can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

<u>Newcomers in Garza County</u> may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Climate."

<u>Cover picture:</u> Aerial view of contour farming and parallel terraces on Acuff loam, 0 to 1 percent slopes.

CONTENTS

SOIL SURVEY OF GARZA COUNTY, TEXAS

BY WAYNE E. RICHARDSON, DARRELL G. GRICE, AND LEE A. PUTNAM,

SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE,

IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

GARZA COUNTY is located in the Southern Plains of Texas (fig. 1). The western one-fifth of the county is in the Southern High Plains resource area, and the rest is in the Central Rolling Red Plains resource area. Post, the largest town and the county seat, is about 40 miles southeast of Lubbock, Texas. The county is about 30 miles square and has a total area of 585,600 acres.

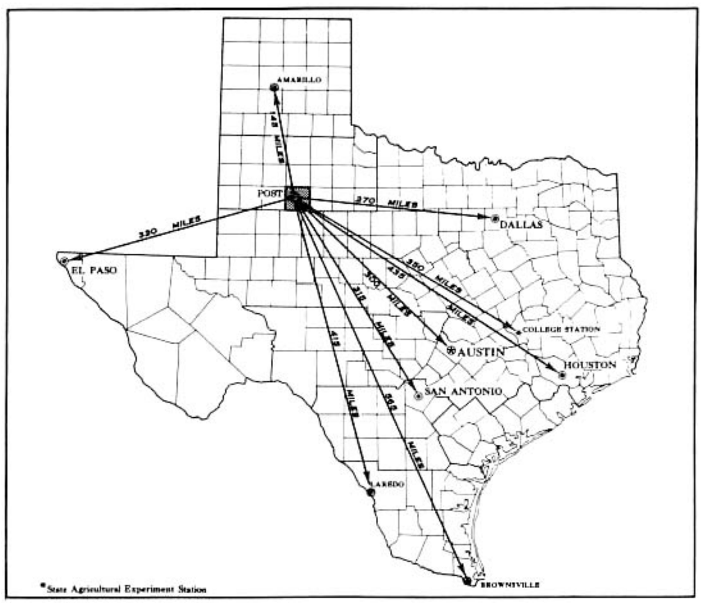


Figure 1.—Location of Garza County in Texas

The High Plains area of the county is nearly level and slopes gradually to the southeast. It is bordered by a caprock escarpment. The Rolling Plains area is gently sloping and has a well-defined drainage pattern. Elevation ranges from about 2,200 feet to 3,000 feet above sea level.

Most of the High Plains part of the county is cultivated. The only areas left in native range are small areas near playa lakes and along the caprock escarpment. Irrigation is used extensively in this part of the county; however, most irrigation wells are small and cannot be used to irrigate the entire cultivated acreage. The principal crops are cotton and grain sorghum, and minor acreages are in small grain and other crops.

Most of the Rolling Plains part of the county is used as range. Cotton and grain sorghum are the principal crops grown in the cultivated areas.

Garza County was formed from part of Bexar County in 1876, but it was not organized until July 8, 1907. In 1907 the area consisted predominantly of ranches, but these began to give way to farming, and Post became the farming center. The railroad that came to Garza County was started in Plainview and in Coleman in 1909. The two sections were joined at Augustus, 6 ½ miles southeast of Post, on May 5, 1911. In the 1911-1912 period, the first contract for an oil well was let. Since 1945, the number of oil wells in the county has increased from 4 to 1,645.

HOW THIS SURVEY WAS MADE

Soil scientists made this survey to learn what kinds of soil are in Garza County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. They observed the steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide uniform procedures. The *soil series* and the *soil phase* (6) are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Olton and Miles, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the natural, undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Miles fine sandy loam, 1 to 3 percent slopes, is one of several phases within the Miles series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this survey was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or phase.

Some mapping units are made up of soils of different series or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Garza County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils joined by a hyphen. The Lincoln-Yahola complex is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly from one another. The name of an association consists of the names of the dominant soils joined by a hyphen. The Mobeetie-Potter association, rolling, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils or of two or more. The name of an undifferentiated group consists of the names of the dominant soils joined by "and." Spade and Veal fine sandy loams, 3 to 5 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey. They are called land types and are given descriptive names. Rough broken land is a land type in Garza County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yield of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Only part of a soil survey is done when the soils have been named, described, and delineated on the map and when the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of people, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. The groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

GENERAL SOIL MAP

The general soil map at the back of this survey shows, in color, the soil associations in Garza County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Garza County are discussed in the following pages. The terms for texture used in the title for several of the associations apply to the surface layer. For example, in the title for association 2, the word “loams” refers to texture of the surface layer.

1. Vernon-Rough broken land Association

Gently sloping to steep, moderately deep clay loams, and rough broken land

This association consists of areas along the major streams in the county. The topography is gently sloping to steep, rolling, and broken (fig. 2). Areas of this association are deeply dissected by geological erosion and have a well-defined drainage pattern. Most of the soils have developed in red-bed clay, shale, and sandstone. This association occupies about 30 percent of the county.

Vernon soils make up about 33 percent of the association. These are moderately deep, very slowly permeable soils on uplands. They have a surface layer of reddish-brown clay loam and lower layers of reddish-brown clay that grades to partially weathered red beds. Vernon soils are on ridges and in areas above drains, which are the smoother parts of this association. Rough broken land makes up about 20 percent of this association. This land type is sloping to steep and is in areas near the larger drainageways. The remaining 47 percent of the association is Abilene, Berda, Dalby, Latom, Lincoln, Miles, Mobeetie, Olton, Spade, Spur, and Veal soils and Badland.

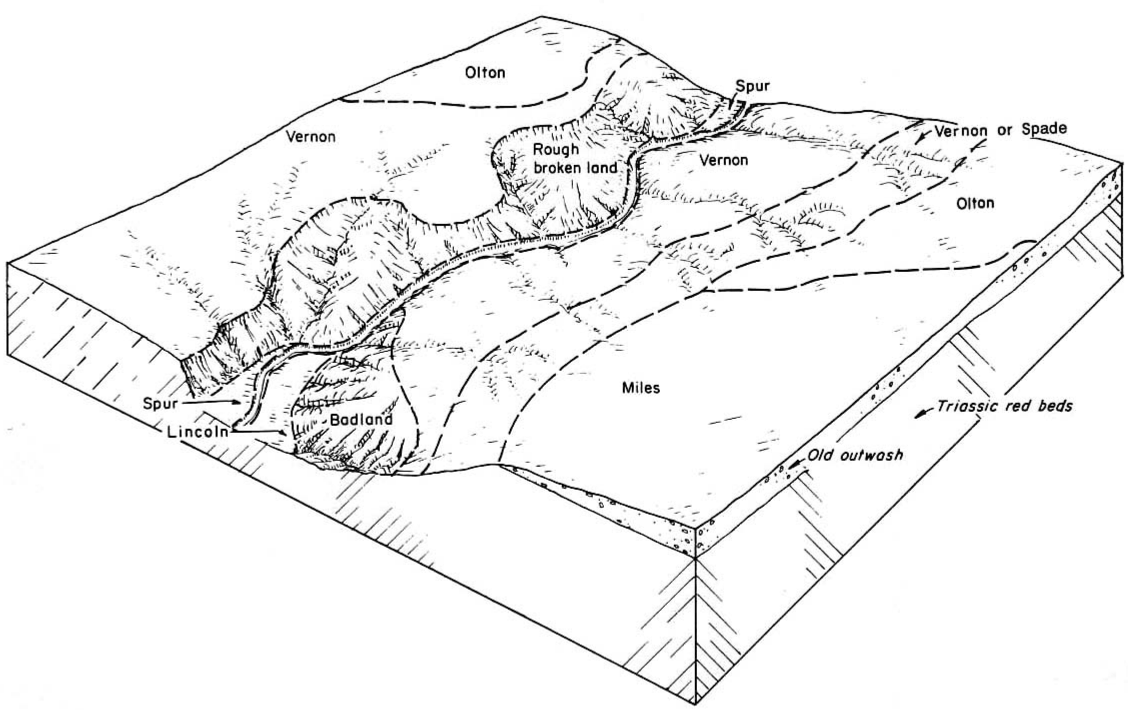


Figure 2.—Typical pattern of soils in the Vernon-Rough broken land association.

Most of the acreage in this association is used for range, but a few areas are cultivated. Most areas are unsuitable for cultivation because of the steep slopes and the broken topography.

2. Olton-Acuff Association

Nearly level to gently sloping, deep loams

This association consists of nearly level to gently sloping soils on plains. Scattered throughout this area are playa basins that receive most of the drainage and surface runoff. This association occupies about 16 percent of the county.

Olton soils make up about 67 percent of this association. These soils have a brown loam surface layer and lower layers of clay loam. Acuff soils make up about 12 percent. These soils have a reddish-brown loam surface layer and lower layers of sandy clay loam. The remaining 21 percent of the association is Amarillo, Drake, Lubbock, Mansker, Portales, Potter, Randall, and Zita soils.

Most of the acreage in this association is cultivated and about 20 to 30 percent of that is irrigated. Some of the acreage is used for range.

3. Miles Association

Nearly level to gently sloping, deep fine sandy loams

This association consists of nearly level to gently sloping soils on upland plains. It makes up about 16 percent of the county.

Miles soils make up about 58 percent of this association. These soils have a surface layer of reddish-brown fine sandy loam and lower layers of sandy clay loam. The remaining 42 percent of this association is Latom, Mobeetie, Olton, Spade, Veal, and Vernon soils.

Most of the acreage in this association is used as range, but some small areas are cultivated.

4. Olton-Vernon Association

Nearly level to gently sloping, moderately deep and deep clay loams

This association consists of nearly level to gently sloping soils on plains that are broken at wide intervals by convex, smooth ridges and hillside slopes. It makes up about 11 percent of the county.

Olton soils make up about 60 percent of this association. These soils have a brown clay loam surface layer and lower layers of clay loam. They lie in the less sloping and smoother areas in this association. Vernon soils make up about 22 percent of the association. They are moderately deep, very slowly permeable soils on uplands. These soils have a surface layer of reddish-brown clay loam and lower layers of clay that parts to partially weathered red beds. Vernon soils occupy the more sloping areas in the association. The remaining 18 percent is Abilene, Berda, Bippus, Miles, Mobeetie, Spade, and Veal soils.

Most of the acreage in this association is in native rangeland. Mesquite trees are common on the deeper soils. A few areas are cultivated.

5. Brownfield-Miles Association

Nearly level to gently sloping and undulating, deep fine sands and loamy fine sands

This association consists of deep, sandy soils (fig. 3). It makes up about 11 percent of the county,

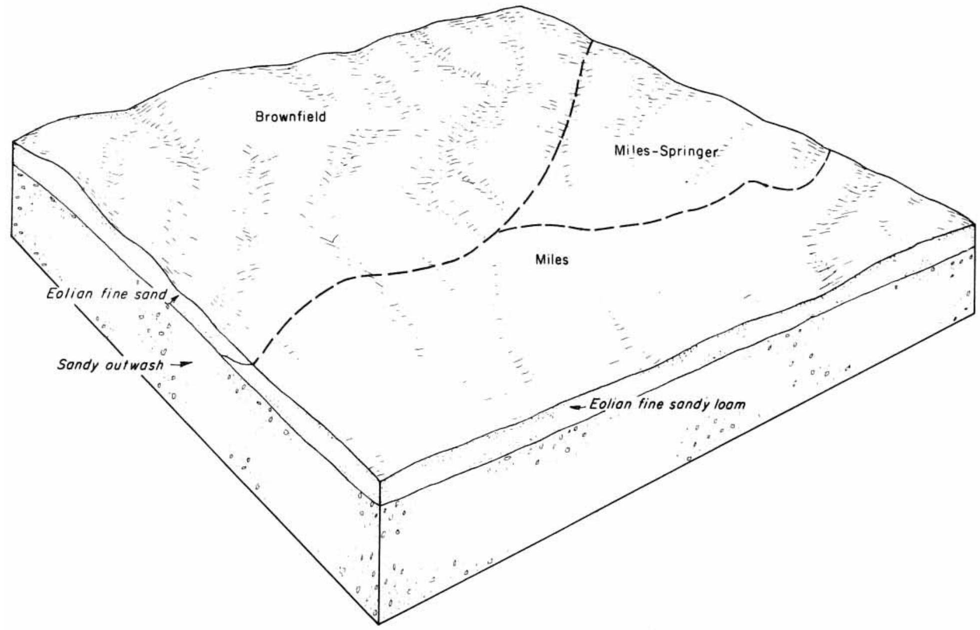


Figure 3.—Typical pattern of soils in the Brownfield-Miles association.

Undulating Brownfield soils make up about 54 percent of this association. These soils have a surface layer of brown fine sand and lower layers of sandy clay loam. Nearly level and gently sloping Miles soils make up about 31 percent. These soils have a brown loamy fine sand surface layer and lower layers of sandy clay loam. The remaining 15 percent of the association is Nobscot, Springer, and Tivoli soils.

Most of the acreage in this association is in native rangeland. A few areas of Brownfield soils have been cultivated, but most of these are now abandoned because of soil blowing. Most cultivated areas consist of Miles soils.

6. Dalby Association

Nearly level to gently sloping, deep clays

This association consists of level to gently sloping soils on large alluvial flats (fig. 4). These flats have developed well-defined patterns of shallow drains. This association occupies about 9 percent of the county.

Dalby soils make up about 75 percent of this association. These soils have a reddish-brown clay surface layer and a lower layer of clay that is underlain by a silty clay loam material. The remaining 25 percent of this association is Berda, Clairemont, Latom, Spade, Spur, and Vernon soils and Rough broken land.

Most of the acreage in this association is in rangeland. It is not well suited to cultivation.

7. Mobeetie-Berda-Rough broken land Association

Gently sloping to steep, deep fine sandy loams and loams, and rough broken land

This association consists of the caprock escarpment and the soils immediately below the escarpment (fig. 5). These soils are in a complex pattern, and the area is a series of escarpments, hills, and valleys. This area has developed a prominent drainage pattern, and water runs off it rapidly. This association occupies about 7 percent of the county.

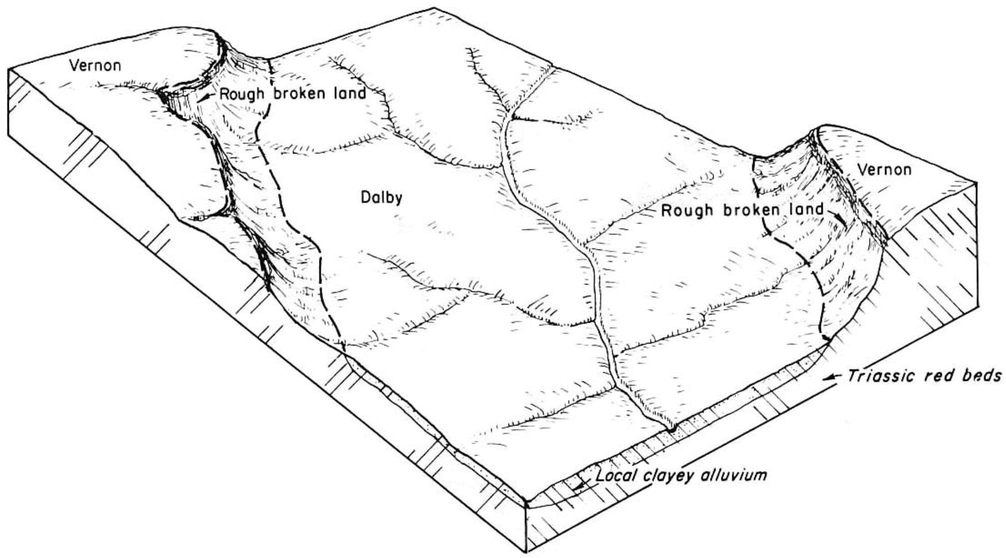


Figure 4.—Typical pattern of soils in the Dalby association.

Mobeetie soils make up about 34 percent of this association. These soils have a brown, calcareous, fine sandy loam surface layer and lower layers of brown fine sandy loam that grades to reddish-brown sandy clay loam at a depth of about 36 inches. They are in the smoother areas below the Rough broken land. Berda soils make up about 30 percent. These soils have a brown loam surface layer and lower layers of clay loam. They are in the smoother areas below the Rough broken land. Rough broken land makes up about 25 percent of this association. This land type consists of the sloping to steep areas along the caprock escarpment. The remaining 11 percent is Bippus, Mansker, Miles, Potter, Veal, and Vernon soils.

Most of the acreage in this association is in native rangeland. A few areas of the Mobeetie and Berda soils are cultivated. Geological erosion continues to advance the escarpments, erode away the hills, and deepen the valleys.

DESCRIPTIONS OF THE SOILS

This section describes the soil series and mapping units of Garza County. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

In the pages that follow, a general description of each soil series is given. Each series description has a detailed description of a profile typical of the series and a brief statement of the range in characteristics of the soils in the series as mapped in this county. Following the series description, each mapping unit in this series is described individually. For full information on any one mapping unit, it is necessary to read the description of the soil series as well as the description of the mapping unit. Miscellaneous land types, such as Rough broken land, are described in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. At the end of the description of each mapping unit are listed the capability unit and the range site in which the mapping unit has been placed.

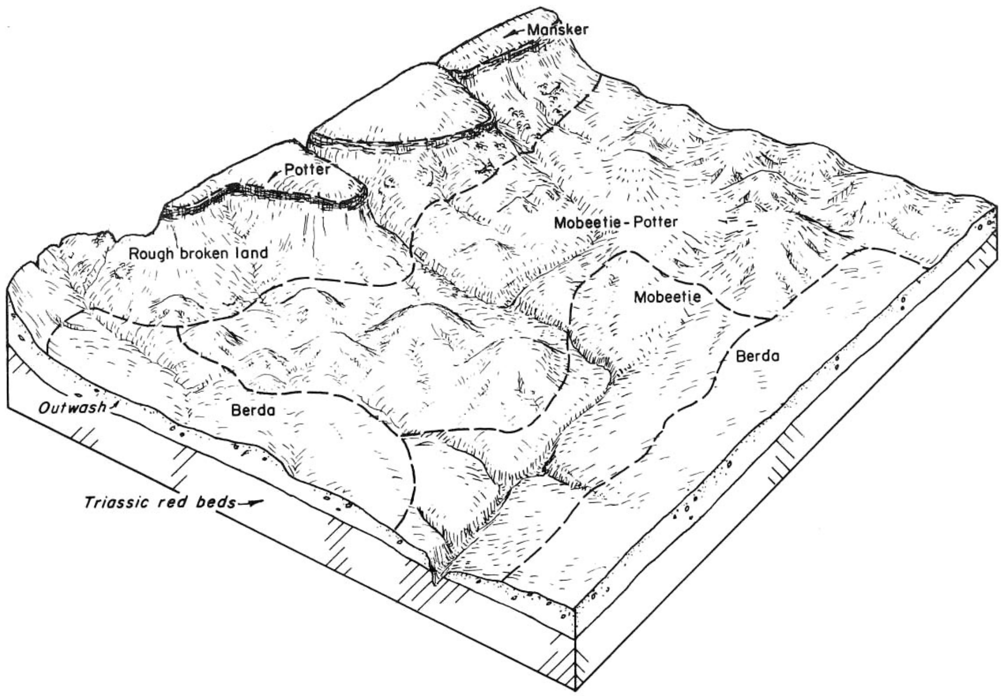


Figure 5.—Typical pattern of soils in the Mobeetie-Berda-Rough broken land association.

For more general information about the soils, the reader can refer to the section "General Soil Map" in which the broad patterns of soils are described. Many of the terms used in the soil descriptions and other parts of the report are defined in the Glossary.

Soil colors in the following descriptions are Munsell color notations and are of dry soil unless specified moist.

Abilene Series

The Abilene series consists of deep, moderately slowly permeable soils on uplands.

In a representative profile, the surface layer is very dark grayish-brown clay loam about 6 inches thick. The next layer is about 38 inches thick. It is very dark grayish-brown, firm clay loam in the upper part and brown, very firm clay in the lower part. The underlying material to a depth of 74 inches is reddish-yellow, calcareous, friable clay loam. The upper 20 inches contains about 20 percent soft lumps of calcium carbonate.

These soils are well drained and have a high available water capacity.

Representative profile of Abilene clay loam, 0 to 1 percent slopes, in rangeland 100 feet south of a county road from a point that is 0.8 mile northeast of cattle guard on OS Ranch, from a point that is 9.7 miles along Farm Road 2458 from its intersection with U.S. Highway 84 at Justiceburg:

A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) clay loam; very dark brown (10YR 2/2) moist; moderate, medium, granular structure; hard, friable; few worm casts; few fine pores; mildly alkaline; clear, smooth boundary.

B21t—6 to 13 inches, very dark grayish-brown (10YR 3/2) clay loam; very dark brown (10YR 2/2) moist; moderate, fine, blocky structure; hard, firm; few worm casts; few fine pores; few patchy clay films; mildly alkaline; gradual, smooth boundary.

B22t—13 to 38 inches, brown (7.5YR 5/2) clay; dark brown (7.5YR 3/2) moist; moderate, medium, blocky structure; very hard, very firm; patchy clay films; calcareous; moderately alkaline; gradual, smooth boundary.
B23t—38 to 44 inches, brown (7.5YR 5/3) clay; dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; very hard, very firm; patchy clay films; few, fine quartz pebbles; calcareous; moderately alkaline; gradual, smooth boundary.
C1ca—44 to 64 inches, reddish-yellow (5YR 6/6) clay loam; yellowish red (5YR 5/6) moist; massive (structureless); hard, friable; 15 to 20 percent soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.
C2—64 to 74 inches +, reddish-yellow (5YR 6/6) clay loam; yellowish red (5YR 5/6) moist; massive (structureless); hard, friable; common films and threads and a few soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 5 to 8 inches in thickness. Color is dark brown to very dark grayish brown. The Bt horizon ranges from 20 to 50 inches in thickness. It is very dark grayish brown to brown in the upper part and brown to reddish-brown in the lower part. Texture ranges from clay loam to clay, and structure ranges from moderate, medium, subangular blocky to moderate, fine, blocky. The thickness of the C1ca horizon ranges from 7 to 24 inches, and the content of calcium carbonate ranges from 5 to 40 percent. Depth to the C horizon ranges from about 32 inches to 75 inches. The texture of the C horizon is clay loam to clay.

Abilene clay loam, 0 to 1 percent slopes (AbA).—This soil is in slightly concave areas near drainageways or on broad plains. Areas of this soil are irregular in shape and are 10 to 400 acres in size. Slope is dominantly about 0.5 percent.

Included with this soil in mapping are small areas of Olton clay loam. Also included are some small areas of soils that are calcareous to the surface and a few areas of soils that have clayey red beds at a depth of 30 to 60 inches.

About 20 percent of this soil is cultivated, and the rest is used for range. The hazard of soil blowing is slight. (Capability unit IIce-4, dryland; Deep Hardland range site)

Acuff Series

The Acuff series consists of deep, well-drained, moderately permeable soils on uplands.

In a representative profile, the surface layer is a reddish-brown loam about 6 inches thick. The next layer extends to a depth of 65 inches. In sequence from the top, the upper 8 inches is reddish-brown loam; the next 10 inches is reddish-brown sandy clay loam; the next 16 inches is yellowish-red sandy clay loam; the next 20 inches is pink sandy clay loam that contains about 25 percent calcium carbonate; and the lower part is reddish-yellow, calcareous sandy clay loam.

These soils have a high available water capacity. The hazard of soil blowing is slight.

Representative profile of Acuff loam, 0 to 1 percent slopes, in a cultivated field 150 feet east of a county road from a point that is 1.45 miles north of a point that is 0.65 mile northwest along the railroad from a point that is 0.2 mile north of a point that is 0.42 mile east of the intersection of U.S. Highway 84 and the county road at Southland:

Ap—0 to 6 inches, reddish-brown (5YR 4/3) loam, dark reddish-brown (5YR 3/3) moist; weak, granular structure; hard, friable; neutral; abrupt, smooth boundary.

B21t—6 to 14 inches, reddish-brown (5YR 4/3) loam, dark reddish-brown (5YR 3/3) moist; weak, medium, prismatic structure parting to coarse, subangular blocky structure; very hard, friable; common worm casts; common fine pores; mildly alkaline; clear, smooth boundary.
B22t—14 to 24 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish-brown (5YR 3/4) moist; moderate, medium, prismatic structure parting to moderate, medium and fine, subangular blocky structure; very hard, friable; few clay films on ped surfaces; common worm casts; common fine pores; moderately alkaline; gradual, smooth boundary.
B23t—24 to 40 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, medium, prismatic structure; very hard, friable; common films and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.
B24tca—40 to 60 inches, pink (5YR 7/4) sandy clay loam, light reddish-brown (5YR 6/4) moist; weak, medium, prismatic structure; hard, friable; many, medium and fine calcium carbonate concretions, 25 percent by volume; calcareous; moderately alkaline; gradual, wavy boundary.
B25tca—60 to 65 inches +, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, medium, prismatic structure; hard, friable; common, medium and fine calcium carbonate concretions, 10 to 15 percent by volume; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 4 to 12 inches. Color of this horizon is reddish-brown to brown. Color of the B2t horizon above the Btca horizon is reddish-brown to brown in the upper part and reddish-brown to yellowish red in the lower part. Texture is loam, sandy clay loam, or clay loam, and structure ranges from weak to moderate. Depth to the Btca horizon ranges from 24 to 60 inches, and its thickness is 10 to 25 inches or more. It contains from 15 to 40 percent calcium carbonate. The B2t horizon below the Btca horizon is several feet thick. Texture ranges from sandy clay loam to clay loam.

Acuff loam, 0 to 1 percent slopes (AcA).—This soil is in smooth areas along the eastern edge of the High Plains. Areas of this soil range from 40 to 400 acres in size. Slopes are dominantly less than 0.5 percent. The profile of this soil is the one described as representative for the series.

Included with this soil in mapping are small areas of Amarillo fine sandy loam and Olton loam. Also included are a few areas, 1 to 2 acres in size, of Portales loam, Mansker loam, and Zita loam.

About 90 percent of this soil is cultivated, and about 10 percent of this is irrigated. The remaining 10 percent is in rangeland. Surface runoff is slow. (Capability unit IIIce-2, dryland, and I-2, irrigated; Deep Hardland range site)

Acuff loam, 1 to 3 percent slopes (AcB).—This soil lies in round or semicircular areas that are generally less than 100 acres in size. These areas are mainly above playas. Slopes are from 1 to 3 percent but are dominantly about 1.5 percent. The effects of erosion are noticeable in a few areas where a few small gullies occur and the surface layer has been thinned by water erosion.

The surface layer is a reddish-brown, noncalcareous loam about 6 inches thick. The next layer is sandy clay loam. It is reddish-brown and noncalcareous in the upper 10 inches and calcareous, friable, and yellowish red in the next 24 inches. Below this is pink sandy clay loam that contains about 25 percent calcium carbonate. This grades to reddish-yellow, calcareous sandy clay loam.

Included with this soil in mapping are a few areas of Amarillo fine sandy loam and Olton loam. Also included are a few small areas of Portales and Mansker loams.

About 90 percent of the acreage is cultivated, but only a small amount of this is irrigated. The remaining 10 percent is in rangeland. Hazard of water erosion is moderate. (Capability unit IIIe-2, dryland, and IIe-1, irrigated; Deep Hardland range site)

Amarillo Series

The Amarillo series consists of deep, moderately permeable soils on uplands.

In a representative profile, the surface layer is brown, noncalcareous fine sandy loam about 8 inches thick. The next layer is friable sandy clay loam to a depth of 60 inches. It is reddish-brown in the upper 19 inches and yellowish red in the next 16 inches. In the next 13 inches, it is pink and contains about 60 percent calcium carbonate. In the lower 4 inches, it is pink and calcareous.

These soils are well drained and have a high available water capacity. The hazard of soil blowing is moderate.

Representative profile of Amarillo fine sandy loam, 1 to 3 percent slopes, in a cultivated field 200 feet east of a county road, 1 mile north of a point that is 0.65 mile northwest along the railroad from a point that is 0.2 mile north of a point that is 0.42 mile east of the intersection of U.S. Highway 84 and the county road at Southland:

Ap—0 to 8 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak granular structure; hard, friable; mildly alkaline; abrupt, smooth boundary.

B21t—8 to 27 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish-brown (5YR 3/4) moist; moderate, very coarse, prismatic structure; very hard, friable; common worm casts; common fine pores; few patchy clay films; mildly alkaline; clear, wavy boundary.

B22t—27 to 43 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, very coarse, prismatic structure; very hard, friable; few worm casts; few fine pores; few patchy clay films; few films of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B23tca—43 to 56 inches, pink (5YR 8/4) sandy clay loam, pink (5YR 7/4) moist; weak, very coarse, prismatic structure; hard, friable; many, fine to medium, soft masses and concretions of calcium carbonate, about 60 percent by volume; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—56 to 60 inches +, pink (5YR 7/4) sandy clay loam, light reddish-brown (5YR 6/4) moist; weak, coarse, prismatic structure; hard, friable; few patchy clay films; soft masses and concretions of calcium carbonate, about 25 percent by volume; calcareous; moderately alkaline.

The thickness of the horizon ranges from 6 to 15 inches. Color is brown to reddish-brown. The B2t horizon above the B2tca horizon is reddish-brown to yellowish red. Texture is fine sandy loam to sandy clay loam that has a clay content between 18 and 30 percent. Structure ranges from prismatic to subangular blocky. The Btca horizon begins at a depth of 30 to 60 inches. Calcium carbonate content ranges from 25 to 70 percent by volume.

Amarillo fine sandy loam, 0 to 1 percent slopes (AmA).—This soil is on the High Plains in areas that are 10 to 100 acres in size and are irregular in shape. Slopes are dominantly about 0.5 percent. Soil blowing has removed some of the fine particles from the surface layer, and some sheet erosion has occurred in a few areas.

This soil has a brown, noncalcareous, fine sandy loam surface layer about 8 inches thick. The next layer is sandy clay loam. It is reddish-brown and friable in the upper 19 inches and yellowish red and calcareous in the next 16 inches. Below this, it is pink and contains about 60 percent calcium carbonate. This grades to pink, friable sandy clay loam that contains about 25 percent calcium carbonate.

Included with this soil in mapping are small areas that are calcareous to the surface. Small areas of Acuff loam and Olton loam are also included.

Most areas of this soil are cultivated, but only a small amount of this is irrigated. (Capability unit IIIe-4, dryland, and IIe-4, irrigated; Sandy Loam range site)

Amarillo fine sandy loam, 1 to 3 percent slopes (AmB).—This soil is in areas around playas. These areas are 12 to 80 acres in size and are irregular in shape. Slopes are dominantly about 2 percent. Small gullies occur in some places. In some areas wind has removed some of the fine particles from the surface layer, and sheet erosion has removed a few inches of the surface layer.

Included with this soil in mapping are small areas of soils that are calcareous to the surface. Areas of Acuff loam, Portales loam, and Mansker loam are also included.

Almost all areas of this soil are dryland cultivated. The hazard of water erosion is moderate. (Capability unit IIIe-4, dryland, and IIe-6, irrigated; Sandy Loam range site)

Badland

Badland (Ba) consists of severely eroded and gullied areas of clay or shaly clay red beds. These areas are 20 to 600 acres in size and are irregular in shape. In a few areas there are rounded or partially rounded rock fragments 3 to 7 inches in diameter that cover about 10 percent of the surface. Areas of this land type lack soil development and are mostly bare of vegetation (fig. 6). Slopes are from 1 to 50 percent. Water runoff is very rapid. Geological erosion is active.

This land type has little potential for grazing. Some grazing, however, is provided by small included areas of Berda loam, Vernon soils, and Dalby clay. (Capability unit VIIIs-1, dryland; range site not assigned)

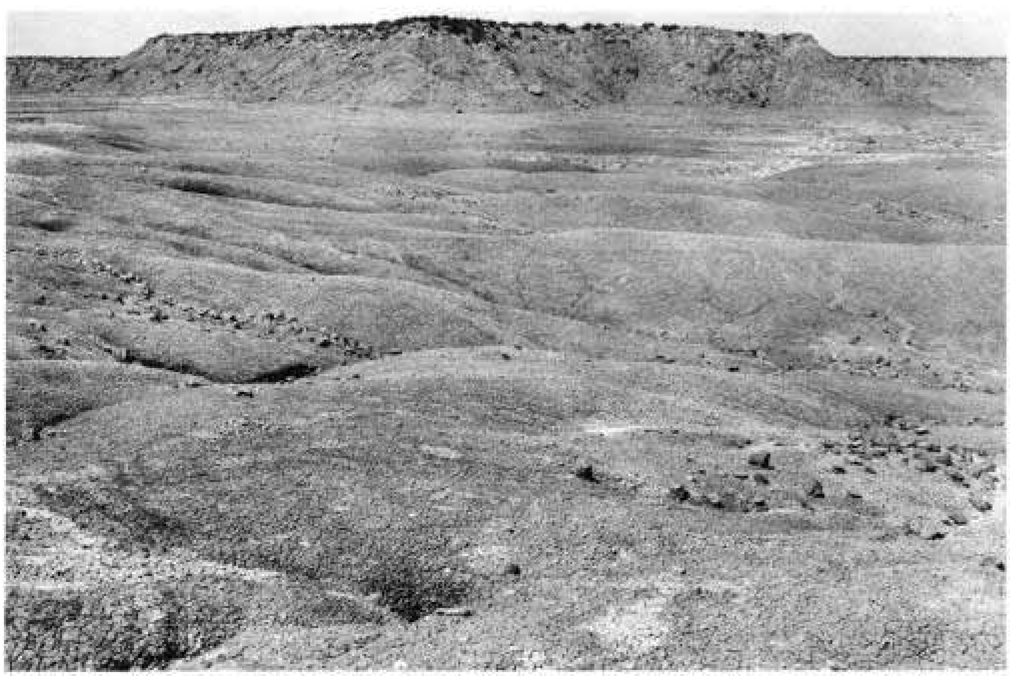


Figure 6.—Area of Badland.

Berda Series

The Berda series consists of deep, moderately permeable, calcareous soils on uplands.

In a representative profile, the surface layer is brown, calcareous loam about 8 inches thick. The next layer is brown, friable clay loam about 22 inches thick. The underlying material is light reddish-brown clay loam that has a slight accumulation of calcium carbonate in the upper 18 inches.

These soils are well drained and have a high available water capacity. The hazard of soil blowing is slight.

Representative profile of Berda loam, 3 to 5 percent slopes, in rangeland 300 feet north of Farm Road 211, from a point that is 1.85 miles east of its junction with U.S. Highway 84, about 10 miles northwest of Post:

A1—0 to 8 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 4/2) moist; weak, granular structure; slightly hard, friable; many worm casts; calcareous; moderately alkaline; clear, smooth boundary.

B2—8 to 30 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate, coarse, prismatic structure parting to weak, fine, subangular blocky structure; slightly hard, friable; many worm casts; many fine pores; few fine concretions and few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—30 to 48 inches, light reddish-brown (5YR 6/4) clay loam, reddish-brown (5YR 5/4) moist; weak, coarse, prismatic structure; slightly hard, friable; common, medium to fine calcium carbonate concretions, 10 percent by, volume; calcareous; moderately alkaline; gradual, wavy boundary.

C2—48 to 60 inches +, light reddish-brown (5YR 6/4) clay loam, reddish-brown (5YR 4/4) moist; massive (structureless); slightly hard, friable; few films and threads of medium to fine, soft calcium carbonate concretions; calcareous; moderately alkaline.

The thickness of the A horizon ranges from 6 to 18 inches. Color is dark brown to reddish-brown. The thickness of the B2 horizon is 17 to 38 inches. Color ranges from reddish gray to light yellowish brown. The calcium carbonate content of the C1ca horizon ranges from 2 to 15 percent. Depth to the C1ca horizon is from 23 to 56 inches. Color ranges from light reddish-brown to pinkish white. Texture of the profile is loam, sandy clay loam, and clay loam.

Berda loam, 1 to 3 percent slopes (BeB).—This soil is in concave, plane, and convex areas and on foot slopes below the caprock escarpment. Slopes are dominantly less than 2 percent. Most areas are long and narrow and are from 5 to 300 acres in size. A few areas are eroded. Gullies have been formed by runoff water from areas above these soils.

The surface layer is reddish-brown, friable, calcareous loam about 10 inches thick. The next layer is a light reddish-brown, friable sandy clay loam about 22 inches thick. The underlying material is pinkish white clay loam that contains a slight accumulation of calcium carbonate in the upper part.

Included with this soil in mapping are areas of Bippus loam in concave areas, of Vernon soils on small ridges, and of Mobeetie fine sandy loam.

About 15 percent of the acreage of this soil is in cropland; the rest is in rangeland. The hazard of water erosion is moderate. (Capability unit IIIe-2, dryland; Deep Hardland range site)

Berda loam, 3 to 5 percent slopes (BeC).—This soil is mostly on foot slopes below the caprock escarpment. Areas of this soil are irregular in shape and range from 20 to 300 acres in size. Slopes are plane to convex. The drainage pattern is well defined. Slopes are dominantly about 4 percent. A few cultivated areas are eroded. Accelerated gully erosion is damaging some trails, roads, and natural drainageways in the range areas. Sheet erosion has removed a few inches of the surface layer. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are small areas of Bippus loam, Mobeetie fine sandy loam, Vernon soils, Badland, Potter soils, and Veal fine sandy loam.

A few areas of this soil are cultivated, but most areas are used as rangeland. The hazard of water erosion is moderate. Surface runoff is medium. (Capability unit IVe-2, dryland; Deep Hardland range site)

Bippus Series

The Bippus series consists of deep, moderately permeable soils on uplands.

In a representative profile, the surface layer is dark-brown loam about 22 inches thick. The next layer is brown clay loam about 14 inches thick. This layer is underlain by reddish-brown clay loam at a depth of about 36 inches.

These soils are well drained and have a high available water capacity.

Representative profile of Bippus loam, 1 to 3 percent slopes, in a cultivated field 100 feet west of a county road, from a point that is 0.45 mile north of the junction of the county road and U.S. Highway 84, which is about 2.3 miles northwest on U.S. Highway 84 from its intersection with U.S. Highway 380 in Post:

Ap—0 to 8 inches, dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, friable; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—8 to 22 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure; hard, firm; many worm casts; many fine and medium pores; calcareous; moderately alkaline; gradual, smooth boundary.

B2—22 to 36 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) moist; weak, fine, subangular blocky structure; very hard, very firm; common worm casts; many fine pores; few films and threads of calcium carbonate in lower part; calcareous; moderately alkaline gradual, smooth boundary.

Cca—36 to 64 inches +, reddish-brown (5YR 5/4) clay loam, reddish-brown (5YR 4/4) moist; massive (structureless); very hard, friable; many fine pores; common threads and films of calcium carbonate; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 20 to 30 inches, and color is dark brown to very dark brown. Thickness of the B2 horizon ranges from 10 to 30 inches, and color is light reddish-brown to brown. The texture of the B2 horizon ranges from loam to clay loam, and the structure is weak to moderate, fine to medium, subangular blocky or granular. Depth to the Cca horizon ranges from 30 to 60 inches. Texture ranges from clay loam to loam, and color is light reddish-brown to brown.

Bippus loam, 1 to 3 percent slopes (BpB).—This soil is on alluvial fans in concave areas that are slightly lower than the surrounding landscape. Areas range from 5 acres to several hundred acres in size and are long and narrow. Slopes are dominantly less than 2 percent.

Included with this soil in mapping are small areas of Berda loam and Abilene clay loam. Also included are a few small areas of soils that have a fine sandy loam surface layer and areas of soils that are nearly level.

About half of the acreage of this soil is cultivated, and half is in rangeland. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. (Capability unit IIIe-2, dryland; Deep Hardland range site)

Brownfield Series

The Brownfield series consists of deep, moderately permeable soils on uplands.

In a representative profile, the surface layer is brown fine sand about 6 inches thick. Below this layer is loose, pale-brown fine sand about 18 inches thick. The next layer is yellowish-red sandy clay loam about 40 inches thick. This layer is underlain by yellowish-red fine sandy loam at a depth of about 64 inches.

These soils are well drained and have a low available water capacity.

Representative profile of Brownfield fine sand, 1 to 5 percent slopes, in rangeland 200 feet south of a county road, from a point that is 0.75 mile west of Grassbur and about 13 miles northeast of Post:

A1—0 to 6 inches, brown (7.5YR 5/2) fine sand, dark brown (7.5YR 4/2) moist; single grain (structureless); loose; slightly acid; clear, smooth boundary.

A2—6 to 24 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain (structureless); loose; slightly acid; abrupt, wavy boundary.

B2t—24 to 48 inches, yellowish-red (5YR 4/6) sandy clay loam, yellowish red (5YR 3/6) moist; moderate, very coarse, prismatic structure; very hard, friable; clay films on ped surfaces; few worm casts; many fine pores; slightly acid; gradual, smooth boundary.

B3—48 to 64 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, very coarse, prismatic structure; very hard, friable; slightly acid; diffuse, wavy boundary.

C—64 to 80 inches +, yellowish-red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; massive (structureless); hard, friable; neutral.

Thickness of the A1 horizon ranges from 5 to 8 inches, and color is brown to light brown or pale brown. The A2 horizon ranges from 15 to 30 inches in thickness and is light brown to pale brown. The B2t horizon ranges in thickness from 14 to 40 inches and is red to reddish-brown or yellowish red. Structure of the B2t horizon ranges from coarse subangular blocky to very coarse prismatic, and texture ranges from fine sandy loam to sandy clay loam. The B3 horizon ranges in thickness from 10 to 18 inches and is red to reddish-yellow or yellowish red. The C horizon ranges in depth from 60 to 98 inches and in texture from fine sandy loam to fine sand.

Brownfield fine sand, 1 to 5 percent slopes (BrC).—This soil is in areas on undulating plains. These areas are from 50 to 2,500 acres in size. Fence rows around the eastern and northern edges of cultivated fields have accumulations of sand several feet thick. Slopes are dominantly 1 to 3 percent.

Included with this soil in mapping are small dunes of Tivoli fine sand and small areas of Miles loamy fine sand and Nobscot fine sand. There are a few small areas of soils that have a surface layer less than 20 inches thick.

Most areas of this soil are used as range, but a small amount is cultivated. Some areas that were cultivated have now returned to grassland. All areas that have been cultivated are eroded to some degree. The hazard of soil blowing is severe. (Capability unit VIe-7, dryland; Deep Sand range site)

Clairemont Series

The Clairemont series consists of deep, moderately permeable soils on bottom lands.

In a representative profile, the surface layer is a reddish-brown, calcareous silt loam about 10 inches thick. The underlying material is light reddish-brown silt loam.

These soils are well drained and have a high available water capacity.

Representative profile of Clairemont silt loam located 250 feet east of a pond, which is about 150 feet east of a county road from a point about 4.5 miles along a county road south and west from its intersection with U.S. Highway 84, which is 0.2 mile southeast of Brazos River bridge on U.S. Highway 84 and about 15 miles southeast of Post:

A1—0 to 10 inches, reddish-brown (5YR 5/4) silt loam, reddish-brown (5YR 4/4) moist; weak, fine, granular structure; soft, very friable; few fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

C—10 to 60 inches +, light reddish-brown (5YR 6/4) silt loam, reddish-brown (5YR 4/4) moist; weak, fine, granular structure; slightly hard, friable; stratified with thin layers of silty clay loam, fine sandy loam, and loamy sand; calcareous; moderately alkaline.

Thickness of the A1 horizon ranges from 6 to 14 inches, and color is reddish-brown to brown. Color of the C horizon is light reddish-brown to reddish-brown, and texture is silt loam to very fine sandy loam. This horizon is stratified with thin layers of silty clay loam, fine sandy loam, loamy sand, and gravel.

Clairemont silt loam (Ca).—This nearly level soil is on flood plains along creeks. Areas of this soil are from 16 acres to more than 600 acres in size and are long and narrow in shape. These areas are generally 20 to 30 feet above bottoms of creek channels. Slope is dominantly less than 0.5 percent

Included with this soil in mapping are some areas that have a higher clay content than that described for the Clairemont series. These areas are flooded about once every 5 to 10 years. Each flood brings deposits of fresh s of l material.

This soil is in rangeland. The hazard of soil blowing is slight. (Capability unit IIce-3, dryland Loamy Bottomland range site)

Dalby Series

The Dalby series consists of deep, very slowly permeable soils on uplands.

In a representative profile, the surface is a reddish-brown, calcareous clay about 6 inches thick. The next layer is reddish-brown, very firm clay about 32 inches thick. This is underlain by yellowish-red silty clay loam. Figure 7 shows a profile of Dalby clay.

Dalby soils have cracks to a depth of 20 inches or more that remain open most of the year. These soils are well drained and have a high available water capacity.

Representative profile of Dalby clay, 0 to 2 percent slopes, in rangeland 1,200 feet southeast along a trail from a point that is 5.85 miles east on a private road from U.S. Highway 84 at Greens tank and about 8.3 miles southeast of Post:

A1—0 to 6 inches, reddish-brown (5YR 5/3) clay, reddish-brown (5YR 4/3) moist; weak, fine, blocky structure; extremely hard, very firm, sticky and plastic; few worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

AC—6 to 38 inches, reddish-brown (5YR 4/3) clay, dark reddish-brown (5YR 3/3) moist; weak, fine, blocky structure, nearly massive when wet; extremely hard, very firm, sticky and plastic; faint slickensides; few, fine, soft masses of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C—38 to 58 inches +, yellowish-red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; massive (structureless); very hard, firm; stratified with thin layers of loam and clay; calcareous; moderately alkaline.

Figure 7.—Profile of Dalby clay, 0 to 2 percent slopes.

The A horizon is 5 to 12 inches in thickness and is reddish-brown to dark brown in color. The AC horizon ranges in thickness from 25 to 38 inches and in color from reddish-brown to red in hues of 2.5YR and 5YR, values of 4 to 5, and aromas of 3 to 6. In places this horizon has a structure that ranges from weak to moderate blocky; in other places it is massive. The C horizon ranges in depth from 35 to 50 inches and in color from yellowish red to red. This horizon is commonly stratified with clay and silty clay loam. Thin layers of loam, silt loam, and clay loam are in some places. The thickness of alluvial material over clayey or shaly red beds is 60 inches or more.

Dalby clay, 0 to 2 percent slopes (DaA).—This soil lies on large, alluvial fans. Areas of this soil range in size from 15 acres to several hundred acres. Drains traverse these areas. These drains are generally 4 to 60 feet wide and 2 to 20 feet deep. Overflow from these drains has deposited sandy and gravelly materials at intervals. Slope is dominantly about 1 percent.

Included with this soil in mapping are small areas of Olton clay loam, Vernon soils, Rough broken land, and overwash of recent clay loam and loam alluvium.

This soil is used for range; however, the clay texture makes it difficult to manage. (Capability unit IIIs-2, dryland; Clay Flats range site)

Drake Series

The Drake series consists of deep, moderately permeable soils on uplands.

In a representative profile, the surface layer is light brownish-gray, calcareous loam about 7 inches thick. The underlying material to a depth of 60 inches is calcareous, friable clay loam that is light gray in the upper 15 inches and white in the lower part.

These soils have a high available water capacity and are well drained. The content of calcium carbonate in these soils is so high that some plant nutrients are in a relatively unavailable form.

Representative profile of Drake loam in an area of Drake soils, 2 to 5 percent slopes, in a cultivated field 0.35 mile north of U.S. Highway 380 from a point that is 0.4 mile east of the intersection of U.S. Highway 380 and Farm Road 1313 near Storie Gin and about 9 miles west of Post:

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak granular structure; soft, very friable; common worm casts; many fine and medium pores; calcareous; moderately alkaline; clear, smooth boundary.

C1—7 to 22 inches, light-gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; weak, coarse, prismatic structure parting to moderate, medium, granular structure; soft, friable; common worm casts; many fine and medium pores; calcium carbonate disseminated throughout; calcareous; moderately alkaline; gradual, wavy boundary.

C2—22 to 60 inches +, white (10YR 8/2) clay loam, light gray (10YR 7/2) moist; massive (structureless); soft, friable; many fine pores; calcium carbonate disseminated throughout; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 6 to 10 inches, texture from fine sandy loam to loam, and color from light brownish gray to pale brown. The C horizon ranges from loam to clay loam. The upper 40 inches of the profile contains from 15 to 70 percent calcium carbonate.

Drake soils, 2 to 5 percent slopes (DrC).—This soil lies on convex mounds on the east and southeast side of playas. Areas of this soil are crescent shaped and range from 10 to 40 acres in size. Slope is dominantly about 3 percent.

Most areas of this soil are cultivated. The hazard of water erosion is moderate, and the hazard of soil blowing is high. (Capability unit IVes-1, dryland; included in the adjoining range sites)

Latom Series

The Latom series consists of shallow and very shallow, slowly permeable soils on uplands. These soils are mapped only in a complex with Mobeetie fine sandy loam.

In a representative profile, the surface layer is pale-brown, calcareous fine sandy loam about 9 inches thick. The underlying material is light brownish-gray, partially weathered sandstone of fine sandy loam texture and is about 3 inches thick. White, hard, calcareous sandstone is at a depth of 12 inches.

These soils are moderately well drained and have a low available water capacity.

Representative profile of a Latom fine sandy loam in an area of Mobeetie-Latom fine sandy loams, 2 to 20 percent slopes, 0.85 mile south from a point that is 0.7 mile west of the northeast corner of section 61, block 6, and about 12 miles south of Post:

A1—0 to 9 inches, pale-brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

C—9 to 12 inches, light brownish-gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; massive (structureless); loose; partially weathered soft sandstone; calcareous; moderately alkaline; abrupt, wavy boundary.

R—12 to 25 inches +, white (5Y 8/2), hard sandstone calcareous; moderately alkaline.

Thickness of the A1 horizon is from 4 to 10 inches, and color ranges from pale brown to reddish-brown. The R horizon is hard sandstone that is white, gray, and red in color. Depth to sandstone ranges from 4 to 20 inches.

Lincoln Series

The Lincoln series consists of deep, rapidly permeable soils on bottom lands.

In a representative profile, the surface layer is light-brown, calcareous loamy fine sand about 15 inches thick. The underlying material is light-brown fine sand of little-altered alluvium that is stratified with thin layers of finer textured materials and gravel.

These soils have a low available water capacity and are somewhat excessively drained. A water table is present in most places at a depth of 4 to 15 feet.

Representative profile of a Lincoln loamy fine sand in an area of Lincoln soils located 200 feet west of Farm Road 669, from a point that is 300 feet north of the north end of the Brazos River bridge, located about 12.3 miles south of Post on Farm Road 669:

A1—0 to 15 inches, light-brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grain (structureless); soft, loose; calcareous; moderately alkaline; clear, smooth boundary.

C—15 to 64 inches +, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; massive (structureless); loose; stratified with thin layers of silt loam, silty clay loam, and gravel; bedding planes are evident; calcareous; moderately alkaline.

Thickness of the A1 horizon ranges from 10 to 20 inches, and texture is fine sandy loam to fine sand. Color ranges from light brown to light yellowish brown. The C horizon ranges in texture from loamy fine sand to fine sand. It is stratified with thin layers of gravel and of silty clay loam to fine sandy loam. Color ranges from light reddish-brown to very pale brown.

Lincoln soils (Ln).—These nearly level soils are on flood plains adjacent to the larger stream channels. They are from 3 to 20 feet above the stream channel and are subject to frequent overflow. Areas of these soils are elongated and irregular in shape and are from 10 to 150 acres in size. Slope is 0 to 1 percent. The Lincoln soils have a profile similar to the one described as representative for the series, but the texture of the surface layer ranges from fine sand to fine sandy loam.

Included with these soils in mapping are small areas of Tivoli fine sand, Spur clay loam, Yahola fine sandy loam, and Clairemont silt loam. Also included are a few areas of small, meandering stream channels,

These soils are not suited to cultivation, because of their texture and the hazard of overflow. All of the acreage of these soils is in rangeland. The hazard of soil blowing is severe. (Capability unit Vw-2, dryland; Sandy Bottomland range site)

Lincoln-Yahola complex (Lo).—This complex consists of nearly level soils on flood plains of rivers and large streams. They are also in the drainageways of small streams on alluvial fans. They are dissected by meandering stream channels and receive deposits of soil material from higher areas. These soils are subject to frequent damaging overflow. Most of the floods are of short duration, and floodwater does not remain for long periods of time.

The Lincoln soils are about 52 percent of this unit. The surface layer is light-brown, calcareous loamy fine sand about 15 inches thick. The underlying material is light-brown, calcareous, loose fine sand that is stratified with thin layers of silt loam, silty clay loam, and gravel.

The Yahola soils are about 28 percent of this unit. The profile of the Yahola soils is similar to the one described as representative of the Yahola series, but the texture of the surface layer ranges from fine sand to clay loam.

About 20 percent of this unit is inclusions of Spur fine sandy loam, Spur clay loam, Clairemont silt loam, Mobeetie fine sandy loam, and Tivoli fine sand.

The soils in this unit are not suited to cultivation, because of frequent flooding. All of the acreage is in native rangeland. (Capability unit Vw-2, dryland; Sandy Bottomland range site)

Lubbock Series

The Lubbock series consists of deep, slowly permeable soils on uplands,

In a representative profile, the surface layer is very dark grayish-brown clay loam about 12 inches thick, The next layer is clay about 26 inches thick. It is very dark grayish brown in the upper 18 inches and grayish brown and friable in the lower 8 inches. The underlying material to a depth of 60 inches is light-gray, friable clay loam in the upper part and sandy clay loam in the lower part and it contains calcium carbonate accumulations.

These soils are moderately well drained. The available water capacity is high.

Representative profile of Lubbock clay loam, 0 to 1 percent slopes, located 200 feet north of a county road from a point that is 0.7 mile west of the 90-degree curve in Farm Road 1313 and 4.7 miles west of Graham:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure; slightly hard, friable; mildly alkaline; abrupt, smooth boundary.

AB—8 to 12 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure; hard, friable; common worm casts; few fine pores; mildly alkaline; clear, smooth boundary.

B21t—12 to 20 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, fine, blocky structure; very hard, firm; few worm casts; few fine pores; thin patchy clay films; mildly alkaline; gradual, smooth boundary.

B22t—20 to 30 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong, fine, blocky structure; very hard, firm; few worm casts; few fine pores; thin continuous clay films; mildly alkaline; gradual, smooth boundary.

B23t—30 to 38 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak, medium, blocky structure; hard, friable; few, thin, patchy clay films; few films and a few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—38 to 48 inches, light-gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; massive (structureless); hard, friable; fine, soft masses and concretions of calcium carbonate, about 25 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

C2—48 to 60 inches +, light-gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; massive (structureless); hard, friable; soft masses and concretions of calcium carbonate, about 15 percent by volume; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 5 to 12 inches, and color is dark brown to very dark grayish brown. The AB horizon is 4 to 6 inches thick. The B2t horizon ranges in thickness from 16 to 35 inches, and color is very dark grayish brown to gray. Texture ranges from clay loam to clay, Depth to the C1ca horizon is from 32 to 53 inches, and color is light brownish gray to light gray. Calcium carbonate content of the C1ca horizon ranges from about 15 to 25 percent. Texture of the C2 horizon ranges from sandy clay loam to clay loam.

Lubbock clay loam, 0 to 1 percent slopes (LuA).—This soil is on narrow benches above playas and in rounded, slightly depressional areas. Areas of this soil are weakly concave and have slopes of dominantly less than 0.5 percent. Where these soils are in slightly depressional areas, they receive some runoff water from the surrounding areas. They range from 5 to 150 acres in size, but most are less than 40 acres.

Included with this soil in mapping are small areas of Randall clay, Portales loam, and Olton loam.

Most areas of this soil are cultivated, and a few of these are irrigated. Runoff is very slow to ponded. The hazard of soil blowing is slight. (Capability unit IIIce-2, dryland, and I-1, irrigated; Deep Hardland range site)

Mansker Series

The Mansker series consists of deep, moderately permeable, calcareous soils on uplands.

In a representative profile, the surface layer is dark-brown, calcareous loam about 7 inches thick. The next layer is brown, friable clay loam about 12 inches thick. The underlying material to a depth of 48 inches is loam. It is light brown and contains about 40 percent calcium carbonate in the upper 19 inches. Below this, it is reddish-yellow.

These soils are well drained. They have a high available water capacity. The hazard of soil blowing is moderate.

Representative profile of Mansker loam, 1 to 3 percent slopes, 0.17 mile north from a point that is 0.48 mile east of U.S. Highway 84, and from a point that is 0.7 mile northwest of the junction of U.S. Highway 84 and Farm Road 2282, about 9 miles northwest of Post on U.S. Highway 84:

Ap—0 to 7 inches, dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; soft, friable; few caliche pebbles on surface and in the horizon; calcareous; moderately alkaline; abrupt, smooth boundary.

B2ca—7 to 19 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate, fine, subangular blocky structure; slightly hard, friable; common worm casts; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—19 to 38 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; slightly hard, friable; common soft masses and concretions of calcium carbonate, about 40 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

C2—38 to 48 inches +, reddish-yellow (7.5YR 7/6) loam, reddish-yellow (7.5YR 6/6) moist; massive (structureless); hard, friable; soft masses and concretions of calcium carbonate that decrease in number with depth; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 7 to 9 inches, and color is brown to dark grayish brown. The B2 horizon ranges in texture from loam to clay loam, in color from reddish-brown to brown, and in thickness from 5 to 13 inches. The C1ca horizon is at a depth of 12 to 20 inches. It contains from 20 to 70 percent calcium carbonate. Color is reddish-yellow, pink, or light brown. The C2 horizon begins at a depth of 20 to 36 inches.

Mansker loam, 0 to 1 percent slopes (MaA).—This soil is in areas on the High Plains. These areas are rounded or irregular in shape and range from 5 to 50 acres in size. Slopes are dominantly about 0.8 percent.

The surface layer is grayish-brown loam about 9 inches thick. The next layer is brown, calcareous clay loam about 11 inches thick. The underlying material is reddish-yellow, friable loam that contains about 40 percent calcium carbonate. Below this is reddish-yellow, calcareous loam.

Included with this soil in mapping are small areas of Portales loam, Acuff loam, and Potter soils.

About 35 percent of this soil is cultivated, and the rest is in rangeland. Soil blowing is a hazard if this soil is unprotected. (Capability unit IVe-9, dryland, and IIIe-10, irrigated; Mixed Plains range site)

Mansker loam, 1 to 3 percent slopes (MaB).—This soil is in areas around playas and above the rim of the caprock escarpment. A few areas are also on knobs and ridges in rolling topography, Areas of this soil are convex and have slopes that are dominantly about 2 percent. Areas range from 5 to 2 30 acres in size but average about 40 acres. Water erosion has cut a few small gullies, and soil blowing has removed a few inches of the surface layer in most cultivated fields. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are small areas of Potter soils, Portales loam, and Acuff loam, and a few areas of soils that have a fine sandy loam surface layer.

This soil is used for crops and range. The hazard of water erosion is moderate. (Capability unit IVe-9, dryland, and IIIe-10, irrigated; Mixed Plains range site)

Mansker loam, 3 to 5 percent slopes (MaC).—This soil is mostly in areas just above the caprock escarpment. These areas are generally long and narrow and range in size from 10 to 150 acres. Slopes are dominantly about 4 percent.

The surface layer is dark-brown, calcareous loam about 7 inches thick. The next layer is reddish-brown, friable, calcareous clay loam about 10 inches thick. The underlying material is pink loam that contains about 30 percent calcium carbonate. Below this is reddish-yellow, calcareous loam.

Included with this soil in mapping are a few areas of Potter soils.

Nearly all the acreage of this soil is used as range. The hazard of water erosion is moderately severe. Excessive runoff from rainfall forms gullies in trails and roads. (Capability unit IVe-2, dryland; Mixed Plains range site)

Miles Series

The Miles series consists of deep, moderately permeable soils on uplands.

In a representative profile, the surface layer is reddish-brown fine sandy loam about 9 inches thick. The next layer is sandy clay loam about 61 inches thick. It is reddish-brown and friable in the upper 17 inches and yellowish red in the lower part. The underlying material to a depth of 76 inches is light reddish-brown, calcareous loam.

These soils are well-drained. They have a high available water capacity.

Representative profile of Miles fine sandy loam, 1 to 3 percent slopes, 1,400 feet west of the 45-degree west turn in the ranch road, from a 'point that is about 1 mile north on ranch road from U.S. Highway 380 and a point that is about 600 feet east of the east end of the Brazos River bridge on U.S. Highway 380, about 10 miles east of Post:

A1—0 to 9 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish-brown (5YR 3/4) moist; weak, fine, granular structure; hard, very friable; few worm casts; neutral; clear, smooth boundary.

B21t—9 to 26 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish-brown (5YR 3/4) moist; moderate, very coarse, prismatic structure; very hard, friable; many worm casts; common fine pores; few clay films on prism faces; neutral; gradual, smooth boundary.

B22t—26 to 48 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, very coarse, prismatic structure; very hard, friable; few worm casts; few clay skins on prism faces; mildly alkaline; gradual, smooth boundary.

B3—48 to 70 inches, yellowish-red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak very coarse, prismatic structure; very hard, friable; mildly alkaline; gradual, wavy boundary.

C1—70 to 76 inches +, light reddish-brown (5YR 6/4) loam, reddish-brown (5YR 5/4) moist; massive (structureless); very hard, friable; few threads and films of calcium carbonate; calcareous; moderately alkaline.

Thickness of the A1 horizon ranges from 7 to 20 inches, and color is pale brown, dark brown, or reddish-brown. The texture is fine sandy loam to loamy fine sand. The B2t horizon ranges in thickness from 19 to 70 inches. Color is dark reddish-brown to yellowish red, and texture is fine sandy loam to sandy clay loam. Thickness of the B3 horizon ranges from 10 to 35 inches. Color is reddish-brown, red, or yellowish red, and texture is fine sandy loam to sandy clay loam. Depth to the C1 horizon ranges from 50 inches to more than 80 inches. The calcium carbonate content ranges from 2 to 15 percent. Color is reddish-yellow to reddish-brown, and texture is loamy fine sand to sandy clay loam.

Miles fine sandy loam, 0 to 1 percent slopes (MfA).—This soil is in slightly convex areas. Areas of this soil are from 20 to 380 acres in size and are irregularly shaped. Most cultivated areas have lost some of the finer particles from the surface layer by soil blowing, and sheet erosion by water has occurred in a few small areas. Slopes are dominantly 0.5 to 1 percent.

The surface layer is dark-brown fine sandy loam about 10 inches thick. The next layer is friable sandy clay loam. It is reddish-brown in the upper 20 inches and yellowish red in the lower 40 inches. The underlying material is reddish-yellow, calcareous loam.

Included with this soil in mapping are small areas of soils that have grayish-brown, calcareous layers and distinct layers of calcium carbonate accumulation. Also included are a few areas that have a loam or sandy clay loam surface layer.

The hazard of soil blowing is moderate. (Capability unit IVe-4, dryland; Sandy Loam range site)

Miles fine sandy loam, 1 to 3 percent slopes (MfB).—This soil is in large, gently undulating areas. These areas are irregularly shaped and are 10 acres to several hundred acres in size. Soil blowing has removed some of the fine particles from the surface layer in cultivated areas. A few gullies are in drainageways in both cultivated and rangeland areas. Slope is dominantly about 2 percent. The profile of this soil is the one described as representative for the series.

Included with this soil in mapping are small areas of Spade fine sandy loam and Olton clay loam. Also included are a few areas of soils that are calcareous in the surface layer and a few small areas of soils that are underlain by red beds or sandstone at a depth of less than 48 inches.

Approximately 75 percent of the acreage is in rangeland, and the rest is cultivated. The hazard of soil blowing is moderate, and the hazard of water erosion is slight. Sheet erosion occurs in some of the more sloping areas. (Capability unit IIIe-4, dryland; Sandy Loam range site)

Miles fine sandy loam, 3 to 5 percent slopes (MfC).—This soil is in areas that are irregular in shape and range in size from 10 acres to several hundred acres. There are some gullies, and sheet erosion by water has thinned the surface layer in most cultivated areas. Soil blowing has removed some of the fine particles of the plow layer. The slope is dominantly about 4 percent.

The surface layer is reddish-brown, friable fine sandy loam about 7 inches thick. The next layer is reddish-brown and yellowish-red, friable, noncalcareous sandy clay loam about 53 inches thick. The underlying material is yellowish-red, friable loam that contains about 15 percent calcium carbonate.

Included with this soil in mapping are small areas of Spade fine sandy loam and Mobeetie fine sandy loam and areas of soils that are underlain by red beds or sandstone.

About 80 percent of this soil is in rangeland, and the rest is cultivated. The hazards of water erosion and soil blowing are moderate. (Capability unit IVe-4, dryland; Sandy Loam range site).

Miles loamy fine sand, 0 to 3 percent slopes (MlB).—This soil is in undulating areas. Most areas of this soil are irregularly shaped and range in size from 30 to 500 acres. Soil blowing has removed some of the surface layer from some cultivated fields. Accumulations of sand several feet thick are along fence rows on the north and east sides of these fields. Slopes are dominantly about 2 percent,

The surface layer is a brown loamy fine sand about 14 inches thick. The next layer is friable sandy clay loam. It is reddish-brown in the upper 17 inches and yellowish red in the lower 33 inches. The underlying material is yellowish-red fine sandy loam.

Included with this soil in mapping are small areas of Brownfield fine sand and Miles fine sandy loam. Also included are some small areas of soils that are calcareous in the surface layer, grayish brown in color, and have a distinct layer of calcium carbonate accumulation at a depth of about 40 inches.

About 50 percent of the acreage of this soil is cultivated. The rest is in rangeland. The hazard of water erosion in the gently sloping areas is slight. The hazard of soil blowing is severe. (Capability unit IVe-6, dryland; Sandyland range site)

Miles-Springer loamy fine sands, 3 to 5 percent slopes (MmC).—The soils in this complex are in long, narrow areas that are from 10 to 300 acres in size. The landscape has a hummocky appearance. Gullies 3 to 15 feet deep and 2 to 20 feet wide are at intervals of about 600 feet. Slope is dominantly 4 to 5 percent.

Miles loamy fine sand is about 65 percent of this complex. It generally occupies the upper slopes and ridgetops. The surface layer is brown loamy fine sand about 11 inches thick. The next layer is reddish-brown, friable sandy clay loam about 30 inches thick. Below this is yellowish-red sandy clay loam.

Springer loamy fine sand is about 20 percent of this complex. It generally occupies lower slopes that are mostly 4 to 5 percent. The profile of Springer loamy fine sand is the one described as representative for the series.

The remaining 15 percent of this unit is inclusions of Brownfield fine sand and Nobscot fine sand; small eroded areas of soils that have had most or all of the surface layer removed by water and wind; and outcrops of gravelly material and red beds.

About 90 percent of the acreage in this complex is in rangeland. A few areas are cultivated, but soil blowing has removed some of the surface layer in these areas. The hazard of soil blowing is severe. (Capability Unit VIe-6, dryland; Sandyland range site)

Mobeetie Series

The Mobeetie series consists of deep, moderately rapidly permeable soils on uplands.

These soils have a brown, calcareous fine sandy loam surface layer about 10 inches thick. The next layer is brown fine sandy loam about 26 inches thick. The underlying material to a depth of 64 inches is reddish-brown sandy clay loam that has a small accumulation of calcium carbonate in the upper 20 inches.

These soils are well drained. The available water capacity is moderate.

Representative profile of Mobeetie fine sandy loam, 3 to 5 percent slopes, 100 feet south of Farm Road 669 from a point that is 0.95 mile southwest of the intersection of Camp Post road and Farm Road 669 and about 2 miles southwest of Post:

A1—0 to 10 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, very fine, granular structure; soft, very friable; many fine and medium pores; many worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B2—10 to 36 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; moderate, very coarse, prismatic structure parting to weak, fine, subangular blocky structure; slightly hard, very friable; many fine and medium pores; many worm casts; few films and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—36 to 56 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish-brown (5YR 4/4) moist; weak, very coarse, prismatic structure; slightly hard, very friable; common fine concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C2—56 to 64 inches +, reddish-brown (5YR 5/4) sandy clay loam, reddish-brown (5YR 4/4) moist; massive (structureless); hard, friable; few films and threads and fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the A1 horizon ranges from 7 to 12 inches and color from light brown to reddish-brown. Structure is granular or subangular blocky. The B2 horizon ranges from 18 to 30 inches in thickness. Color ranges from light reddish-brown to brown and texture from fine sandy loam to loam. Depth to the C horizon ranges from 25 to 42 inches. Thickness of the C1ca horizon ranges from 6 to 30 inches. The C1ca horizon contains 1 to 5 percent visible calcium carbonate by volume. The C horizon ranges from reddish-brown to pink in color and from fine sandy loam to sandy clay loam in texture.

Mobeetie fine sandy loam, 1 to 3 percent slopes (MnB).—This soil is in areas on foot slopes. These areas are irregularly shaped and range from 20 to 200 acres in size. In some cropped areas are a few rills and small gullies. Slopes are dominantly 1.5 percent.

The surface layer is brown, calcareous fine sandy loam about 10 inches thick. The next layer is reddish-brown, friable fine sandy clay loam about 26 inches thick. The underlying material is light reddish-brown, calcareous loam.

Included with this soil in mapping are a few small areas of Spade fine sandy loam, Berda loam, and Bippus loam.

Most areas of this soil are in rangeland, and a few are cultivated. The hazard of soil blowing is moderate. The hazard of water erosion is slight. (Capability unit IIIe-5, dryland; Sandy Loam range site)

Mobeetie fine sandy loam, 3 to 5 percent slopes (MnC).—This soil is on foot slopes below the caprock escarpment and on ridges and hillsides some distance from the escarpment. Areas of this soil range in size from 10 acres to about 200 acres. Slopes are convex and are dominantly about 4 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are small areas of Berda loam and small knobs or ridges of Spade fine sandy loam.

Most areas of this soil are in native rangeland, and a few are farmed. There is some runoff. The hazards of soil blowing and water erosion are moderate. (Capability unit IVe-5, dryland; Sandy Loam range site)

Mobeetie-Latom fine sandy loams, 2 to 20 percent slopes (MoD).—The soils in this complex are on ridges, foot slopes, and hillsides along drainageways (fig. 8). Areas of these soils range in size from 10 to 400 acres. Slopes are mostly convex.

This complex is about 38 percent Mobeetie fine sandy loam, 39 percent Latom fine sandy loam, 19 percent Spade fine sandy loam, and 4 percent other inclusions. Mobeetie fine sandy loam is on foot slopes below ridges and along drainageways. There are gullies in a few of the drainageways. Slopes are dominantly about 5 to 8 percent. Latom fine sandy loam is generally on ridges, and slopes are dominantly about 6 percent. Spade fine sandy loam is generally on hillsides just below the ridges, and slopes are dominantly about 5 percent.

The Mobeetie soil has a brown, calcareous fine sandy loam surface layer about 10 inches thick. The next layer is brown fine sandy loam about 26 inches thick. The underlying material is reddish-brown sandy clay loam that has a small accumulation of calcium carbonate in the upper 20 inches.

The profile of the Latom soil is the one described as representative for the series.

The other inclusions in this mapping unit are small areas of Vernon soils, sandstone outcrops and escarpments, clayey or shaly red-bed outcrops, and a few areas that have slopes of more than 20 percent.

The soils in this unit are used for rangeland. The variability of slopes, the depth of the soils, and the rough topography make these soils unsuitable for cultivation. (Capability unit VIe-3, dryland; Sandy Loam range site)

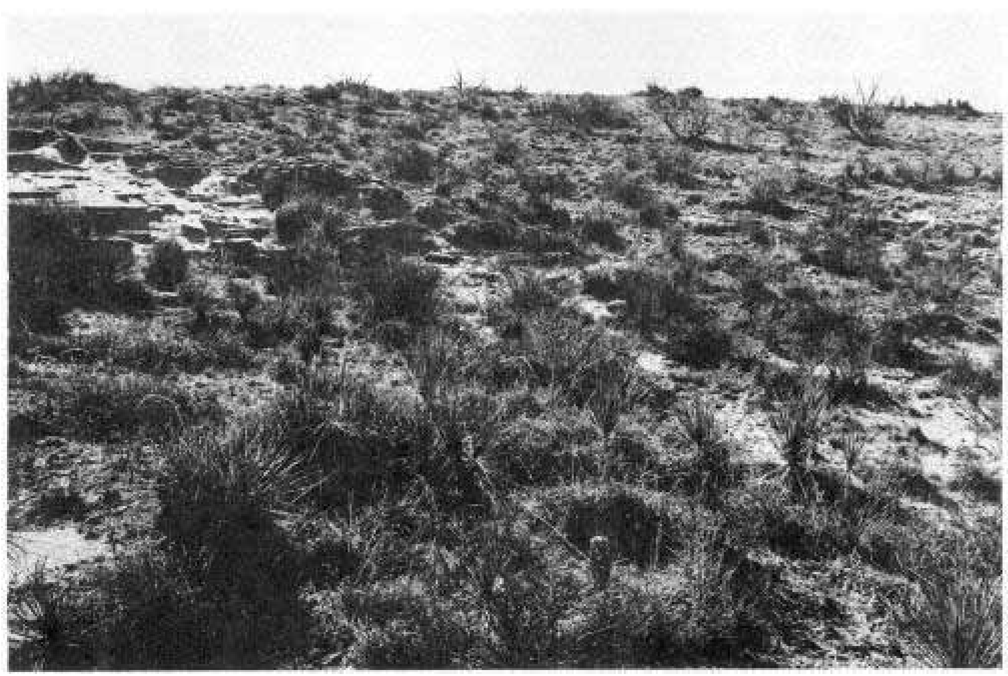


Figure 8.—Area of Mobeetie-Latom fine sandy loams, 2 to 20 percent slopes.

Mobeetie-Potter association, rolling (Mp).—The soils in this association are below or along the caprock escarpment. They are on ridges, knolls, and valleys that have local relief of up to 100 feet. Valleys between the ridges commonly have nearly vertical sides and, in some places, are actively eroding. The ridges and knolls are commonly covered with either caliche or quartzite gravel, or both. Slopes range from 3 to 10 percent normally but are as much as 50 percent. Figure 9 shows an area of the Mobeetie-Potter association.

This mapping unit is about 35 percent Mobeetie fine sandy loam, 16 percent Potter clay loam, 14 percent Veal fine sandy loam, and 35 percent other inclusions. Mobeetie fine sandy loam is on concave foot slopes and on ridges. Slopes are about 3 to 8 percent. Potter clay loam is on the tops of knolls and along the caprock escarpment. Slopes range from 3 to 50 percent but average about 10 percent. Veal fine sandy loam is on low ridges and knolls. Slopes are convex and average about 5 percent.

The Mobeetie soils have a brown, calcareous fine sandy loam surface layer about 10 inches thick. The next layer is brown fine sandy loam about 26 inches thick. The underlying material is reddish-brown sandy clay loam that has a small accumulation of calcium carbonate in the upper 20 inches.

The Potter soils have a brown, calcareous clay loam surface layer about 8 inches thick. The next layer is pink clay loam about 6 inches thick that has fractured caliche fragments coated with calcium carbonate. Pink material is at a depth of 14 inches.

The other inclusions in this mapping unit are areas of Miles fine sandy loam, Bippus loam, and Rough broken land; stream channels; and outcrops of caliche and red beds. Gullies are in a few of the drainageways.

These soils are used as rangeland. The variable slopes, soils, and topography make this unit difficult to manage. (Capability unit VIe-3, dryland; Sandy Loam range site)

Figure 9.—Area of the Mobeetie-Potter association. Potter soils are on the knobs, and Mobeetie soils are in the concave drains.

Figure 9.—Area of the Mobeetie-Potter association. Potter soils are on the knobs, and Mobeetie soils are in the concave drains.

Nobscot Series

The Nobscot series consists of deep, moderately rapidly permeable soils on uplands.

These soils have a brown fine sand surface layer about 6 inches thick. Below this layer is light-brown, loose fine sand about 18 inches thick. The next layer is a yellowish-red, very friable fine sandy loam about 24 inches thick. The underlying material to a depth of 64 inches is loose fine sand that is reddish-brown in the upper part and reddish-yellow in the lower part.

These soils are well drained and have a low available water capacity.

Representative profile of Nobscot fine sand, 0 to 5 percent slopes, 300 feet west of Kent County line from a point that is 1.3 miles west of “K” tank and about 20 miles northeast of Post on the SMS Ranch:

A1—0 to 6 inches, brown (10YR 5/3) fine sand, dark brown (10YR 3/3) moist; single grain (structureless); loose; neutral; clear boundary.

A2—6 to 24 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grain (structureless); loose; slightly acid; gradual, wavy boundary.

B2t—24 to 48 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive (structureless); soft, very friable; contains a few thin bands of fine sandy loam neutral; gradual, smooth boundary.

C1—48 to 60 inches, reddish-brown (5YR 5/4) fine sand, reddish-brown (5YR 4/4) moist; single grain (structureless); loose; neutral; gradual, smooth boundary.

C2—60 to 64 inches +, reddish-yellow (7.5YR 6/6) fine sand, strong brown (7.5YR 5/6) moist; single grain (structureless); loose; neutral.

Thickness of the A1 horizon ranges from 4 to 8 inches, and color is brown to grayish brown. The A2 horizon ranges in thickness from 16 to 30 inches, and color is brown to light yellowish brown. The B2t horizon ranges in thickness from 10 to 30 inches, and color is light reddish-brown to yellowish red. In some places a B3 horizon is present. The C horizon ranges in color from light reddish-brown to reddish-yellow and has a texture of fine sand to loamy fine sand.

Nobscot fine sand, 0 to 5 percent slopes (NoC).—This soil is in undulating areas. Areas of this soil are from 50 acres to several hundred acres in size. Slopes are dominantly about 2 percent. The profile of this soil is the one described as representative for the series.

Included with this soil in mapping are small areas of Brownfield fine sand, Springer loamy fine sand, and Tivoli fine sand.

This soil is in rangeland. Surface runoff is very slow, and the hazard of soil blowing is severe. (Capability unit VIe-7, dryland; Deep Sand range site)

Olton Series

The Olton series consists of deep, moderately slowly permeable soils on uplands.

In a representative profile, the surface layer is brown loam about 8 inches thick. Beneath the surface layer and extending to a depth of 65 inches is clay loam. The upper 6 inches is dark brown and firm. Next is a reddish-brown layer 10 inches thick, a yellowish-red layer 20 inches thick, and a pink layer that is 16 inches thick and contains about 25 percent calcium carbonate. The lower 5 inches is reddish-yellow.

These soils are well drained and have high available water capacity.

Representative profile of Olton loam, 0 to 1 percent slopes, in a cultivated field 100 feet west of Farm Road 398 and 0.4 mile north of Graham:

Ap—0 to 8 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist;

B21t—8 to 14 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure; very hard, firm; common worm casts; common fine pores; very thin clay films on ped faces; mildly alkaline; clear, smooth boundary.

B22t—14 to 24 inches, reddish-brown (5YR 4/4) clay loam, dark reddish-brown (5YR 3/4) moist; moderate, medium and fine, blocky structure; very hard, firm; common fine pores; continuous, distinct clay films on ped faces; mildly alkaline; clear, smooth boundary.

B23t—24 to 44 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate, coarse, blocky structure; very hard, firm; few clay films on ped faces; few films and threads, and few, fine, soft masses of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B24tca—44 to 60 inches, pink (5YR 7/4) clay loam, light reddish-brown (5YR 6/4) moist; weak, medium, subangular blocky structure; hard, friable; many, medium and fine, soft masses and concretions of calcium carbonate; contains about 25 percent calcium carbonate by volume; calcareous; moderately alkaline; diffuse, wavy boundary.

B25t—60 to 65 inches +, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, coarse, blocky structure; very hard, firm; few, thin, patchy clay films on ped faces; common, coarse and medium, soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 5 to 12 inches in thickness, from loam to clay loam in texture, and from brown to reddish-brown in color. Structure of the Bt horizon ranges from weak, fine, subangular blocky to moderate, coarse, blocky; texture is clay loam or light clay. Thickness of the B 21t horizon ranges from 5 to 18 inches, and color is dark brown to reddish-brown. Thickness of the B22t horizon ranges from 6 to 18 inches, and color is dark reddish-brown to brown. Thickness of the B23t horizon ranges from 10 to 24 inches, and color is reddish-brown to reddish-yellow. Thickness of the B24tca horizon ranges from 8 to 20 inches, and depth to this horizon is 26 to 60 inches; color is pink to reddish-yellow, and the content of calcium carbonate ranges from 15 to 50 percent. The B25t horizon is pink or reddish-yellow. The profile is calcareous at a depth of 14 to 24 inches.

Olton clay loam, 0 to 1 percent slopes (OcA).—This soil is on smooth uplands. Areas of this soil are irregular in shape and are generally between 20 and 400 acres in size. The slope is dominantly about 0.5 to 1 percent.

The surface layer is reddish-brown clay loam about 6 inches thick. The next layer is clay loam. It is reddish-brown in the upper 10 inches and yellowish red and firm in the next 30 inches. Below this, it is light reddish-brown and friable, contains about 25 percent calcium carbonate, and grades to yellowish-red, firm, calcareous clay loam (fig. 10).

Included with this soil in mapping are a few small areas of Dalby clay, Abilene clay loam, Miles fine sandy loam, and Vernon clay loam.

About 25 percent of the acreage of this soil is cultivated, and the rest is in rangeland. Runoff is very slow. (Capability unit IIce-4, dryland; Deep Hardland range site)

Olton clay loam, 1 to 3 percent slopes (OcB).—Areas of this soil are irregular in shape and generally are 10 acres to several hundred acres in size. The' slope is dominantly about 2 percent, and surfaces are smooth.

The surface layer is a brown, noncalcareous clay loam about 6 inches thick. The next layer is clay loam that is firm and reddish-brown in the upper 36 inches. Below this it is yellowish red and contains about 20 percent calcium carbonate; this grades to yellowish-red, calcareous clay loam.

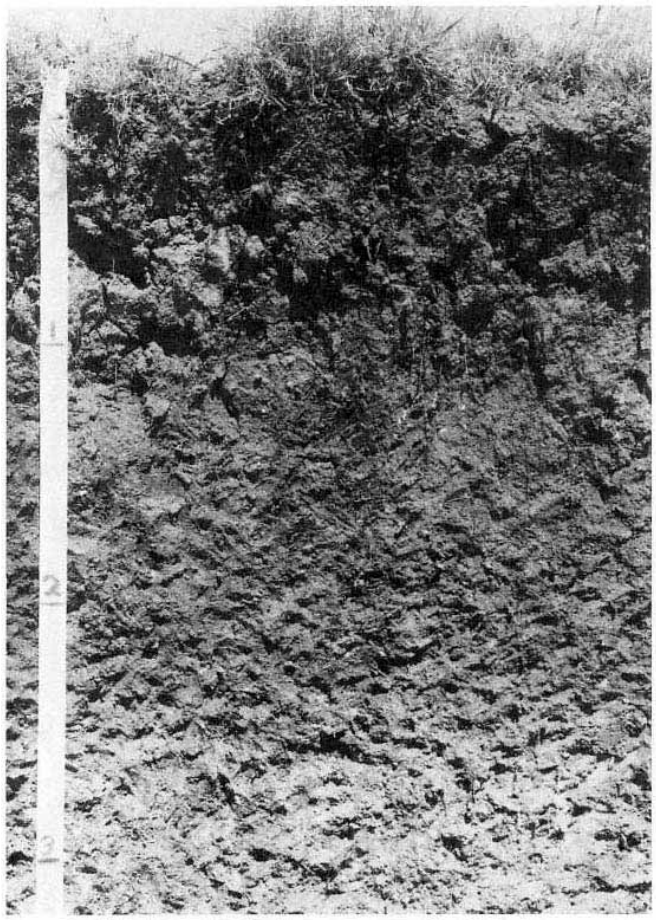


Figure 10.—Profile of an Olton clay loam.

Included with this soil in mapping are small areas of Berda loam, Vernon soils, Dalby clay, Miles fine sandy loam, Bippus loam, and Abilene clay loam.

Most of this soil is used as rangeland, and only about 5 percent is cultivated. Small gullies are in the cultivated areas. The hazard of water erosion is moderate. (Capability unit IIIe-2, dryland; Deep Hardland range site)

Olton loam, 0 to 1 percent slopes (O1A).—This soil occupies large, smooth areas on the High Plains. Areas of this soil are irregular in shape and generally are from 100 acres to several thousand acres in size. The slopes are dominantly less than 0.5 percent. The profile of this soil is the one described as representative for the series. Soil blowing has removed a part of the fine particles from the surface layer.

Included with this soil in mapping are a few small areas of Lubbock clay loam, Mansker loam, Randall clay, Portales loam, Zita loam, and Acuff loam.

Approximately 70 percent of the acreage of this soil is cultivated, and about 35 percent of the cultivated acreage is irrigated (fig. 11). Runoff is very slow. (Capability unit IIIce-2, dryland, and I-1, irrigated: Deep Hardland range site)

Olton loam, 1 to 3 percent slopes (O1B).—This soil is in circular or irregularly shaped areas 20 to 100 acres in size. Many of these areas are around playas. Sheet erosion by water has removed some of the surface layer, and there are a few small gullies in some fields. Also, the wind has removed some of the finer particles from the surface layer. The slope is dominantly about 1.5 percent and smooth.

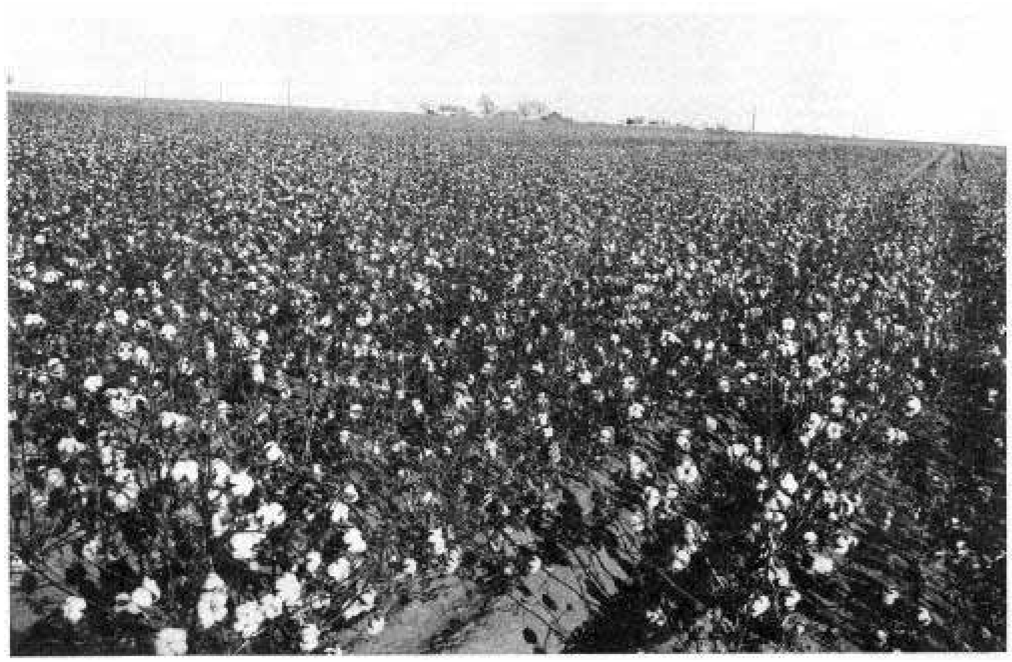


Figure 11.—Irrigated cotton ready for harvest on Olton loam, 0 to 1 percent slopes.

The surface layer is brown, noncalcareous loam about 7 inches thick. The next layer is clay loam that is reddish-brown and yellowish red in the upper 32 inches. Below this, it is yellowish red, contains about 25 percent calcium carbonate, and grades to reddish-yellow, calcareous clay loam.

Included with this soil in mapping are a few small areas of Acuff loam, Portales loam, and Mansker loam.

About 80 percent of the acreage of this soil is cultivated, but only a small amount of this is irrigated. The rest is in rangeland. Water erosion is a moderate hazard. (Capability unit IIIe-2, dryland, and IIe-2, irrigated; Deep Hardland range site)

Portales Series

The Portales series consists of deep, moderately permeable soils on uplands.

These soils have a dark-brown, calcareous loam surface layer about 11 inches thick. The next layer is brown, friable clay loam about 21 inches thick. The underlying material is friable sandy clay loam that is pinkish white and contains about 30 percent calcium carbonate in the upper 18 inches and is pink in the lower part.

These soils are well drained and have a high available water capacity. The hazard of soil blowing is moderate.

Representative profile of Portales loam, 0 to 1 percent slopes, located 150 feet east of ranch road from a point that is located 5.9 miles southwest on a winding county road from a point that is 0.5 mile west and 3 miles south of Graham:

A1—0 to 11 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, very fine, subangular blocky structure; slightly hard, friable; common fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

B2—11 to 32 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; very hard, friable; few worm casts; common, fine, calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

C1ca—32 to 50 inches, pinkish-white (7.5YR 8/2) sandy clay loam, pinkish gray (7.5YR 7/2) moist; weak, fine, subangular blocky structure; hard, friable; medium to very fine soft masses and concretions of calcium carbonate, about 30 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

C2—50 to 60 inches +, pink (7.5YR 8/4) sandy clay loam, pink (7.5YR 7/4) moist; massive (structureless); hard, friable; contains about 10 percent calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges in thickness from 11 to 20 inches and in color from brown to grayish brown. The B2 horizon ranges in thickness from 10 to 30 inches and in color from brown or grayish brown to pale brown or light brown. The C1ca horizon ranges in thickness from 12 to 20 inches, and depth to this horizon ranges from 21 to 50 inches. The content of calcium carbonate is 20 percent to about 60 percent. Color of the C horizon is light brownish gray, pale brown, light brown, pink, or pinkish white.

Portales loam, 0 to 1 percent slopes (PoA).—This soil is on narrow benches in playa basins and in areas near the edge of the plain. Areas of this soil are irregularly shaped and are from 5 to 100 acres in size. Soil blowing has removed some of the fine particles from the surface layer. Slope is dominantly about 0.5 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are a few small areas of Acuff loam, Zita loam, Olton loam, and Mansker loam.

About 75 percent of the acreage of this soil is cultivated, and about 10 percent of this is irrigated. Sheet erosion takes place in a few areas. (Capability unit IIIce-3, dryland, and IIe-3, irrigated; Mixed Plains range site)

Portales loam, 1 to 3 percent slopes (PoB).—This soil is in areas around playa basins or on plains. Areas of this soil are circular or narrow and oblong in shape and are 5 to 30 acres in size. Sheet erosion has removed some of the surface layer, and soil blowing has removed some of the fine particles from the surface layer of some areas of this soil. Most slopes are about 1.5 to 2 percent.

The surface layer is brown, calcareous loam about 11 inches thick. The next layer is brown, friable, calcareous clay loam about 17 inches thick. The underlying material is pink sandy clay loam that contains about 30 percent calcium carbonate in the upper part.

Included with this soil in mapping are a few small areas of Mansker loam and Acuff loam.

About 75 percent of the acreage of this soil is cultivated, but only a small amount of this is irrigated. Water erosion and soil blowing are moderate hazards. (Capability unit IIIe-3, dryland, and IIIe-4, irrigated; Mixed Plains range site)

Potter Series

The Potter series consists of very shallow to shallow, moderately permeable soils that developed in thick beds of caliche on uplands.

In a representative profile, the surface layer is brown, calcareous clay loam about 8 inches thick. The underlying material is pink clay loam about 6 inches thick. It contains fractured caliche rock fragments that are coated with calcium carbonate. Pink, platy caliche is at a depth of 14 inches.

These soils are well drained and have low available water capacity.

Representative profile of a Potter clay loam in an area of Potter soils, 0 to 5 percent slopes, 0.3 mile southwest of gate into U Lazy S pasture, 1.2 miles west on a county road from a point that is 2 miles south of Graham:

A1—0 to 8 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak, very fine, subangular blocky structure; hard, friable; many caliche fragments and common, medium, rounded calcium carbonate concretions; calcareous; moderately alkaline; abrupt, wavy boundary.

C1ca—8 to 14 inches, pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; about 75 percent is fractured caliche fragments with coatings of calcium carbonate; about 25 percent is weakly cemented and powdery calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C2ca—14 to 18 inches +, pink (7.5YR 8/4) platy caliche with hardness of slightly less than 3 and containing soft caliche and intermingled pockets of pinkish loamy earths; calcareous; moderately alkaline.

Color of the A1 horizon ranges from brown to dark grayish brown, structure from granular to subangular blocky, and texture from loam to clay loam. Color of the Cca horizon is pink to very pale brown. Texture of the material between the caliche fragments is loam to clay loam. Depth to the Cca horizon ranges from 4 to 10 inches.

Potter soils, 0 to 5 percent slopes (PtC).—This soil is in areas just above the caprock escarpment. These areas are generally long and narrow and range in size from 5 to 350 acres. Slopes dominantly are about 4 percent.

Included with this soil in mapping are small areas of Mansker loam.

Most areas of this soil are in rangeland where a small amount of geological erosion takes place. A few small areas are cultivated, and in these areas there is a severe hazard of water erosion. The hazards of surface runoff and soil blowing are moderate. (Capability unit VIIs-1, dryland; Very Shallow range site)

Randall Series

The Randall series consists of deep, very slowly permeable soils that occupy the floors of intermittent lakes.

In a representative profile, the surface layer is very firm clay about 24 inches thick. It is dark gray in the upper 8 inches and gray in the lower part. The next layer is calcareous, gray clay about 24 inches thick. The underlying material to a depth of 60 inches is mottled, gray clay. When this soil is dry, it cracks.

Randall soils are somewhat poorly drained. They have a high available water capacity.

Representative profile of Randall clay, 0.4 mile west from a point that is 0.5 mile south on county road from the “S” curve in Farm Road 1313 and about 1.6 miles west of its intersection with Farm Road 669, located about 3 miles southwest of Post:

Ap—0 to 8 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, fine, subangular blocky structure; extremely hard, very firm, plastic and sticky; shiny pressure faces on peds; mildly alkaline; clear, wavy boundary.

A1—8 to 24 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak, fine, blocky structure; extremely hard, very firm, very plastic and very sticky; shiny pressure faces on peds; mildly alkaline; gradual, wavy boundary.

AC—24 to 48 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine, blocky structure; extremely hard, very firm, very plastic and very sticky; shiny pressure faces on peds; calcareous; moderately alkaline; gradual, wavy boundary.

C—48 to 60 inches +, gray (10YR 6/1) clay, gray (10YR 5/1) moist; massive (structureless); extremely hard, very firm, plastic and sticky; common, distinct, pale-yellow mottles; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 10 to 25 inches, and color is dark gray to gray. The AC horizon ranges from 15 to 35 inches in thickness and is dark gray to gray. Depth to the C horizon ranges from 25 to 60 inches, and the color is gray to light gray. Reaction throughout the profile is mildly alkaline to moderately alkaline.

Randall clay (Ra).—This soil occupies circular, depressional areas that are from 1 to 20 feet below the level of surrounding areas and range from 2 to 50 acres in size. Slopes are plane to concave and are less than 0.5 percent. The undisturbed surface of this soil has a gilgai microrelief that has knolls 3 to 7 inches higher than the depressions. The distance from the knolls to the center of the depressions ranges from 5 to 15 feet.

Included with this soil in mapping are some areas that have a clay loam surface layer. Thin deposits of fresh alluvial materials occur where small drainageways empty onto this soil.

About 50 percent of the acreage of this soil is cultivated, but often no crop is harvested because these cultivated areas are flooded by heavy rains. Some areas that receive runoff from the surrounding areas produce a crop in dry years. There is no surface drainage, and water remains in flooded areas until it evaporates. The water enters this soil rapidly when it is dry and cracked; upon wetting, these cracks close, making this soil almost impervious to water. This causes a swelling or heaving of the soil mass. The soil is subject to soil blowing when the surface is bare, which damages nearby soils and crops. (Capability unit VIw-1, dryland; included in the adjoining range sites)

Rough Broken Land

Rough broken land (Ro) is sloping to steep and is in areas along escarpments and in other rough areas. These areas range from 5 acres to several hundred acres in size. They are 150 to 1,500 feet wide and a few hundred feet to several miles long. Local relief is 50 to 200 feet. Deeply incised drainageways have cut into these areas at intervals of 100 to 500 feet. Slopes range from 5 to 80 percent but are dominantly about 30 percent.

Areas of this land type developed in two kinds of material, red beds and caliche. The areas that developed in red beds lie along the rivers and creeks and occur as isolated buttes and ridges. These areas generally have one or more caprocks of exposed sandstone or conglomerate 1 to 15 feet thick. In most red beds, sandstone or conglomerate boulders have broken off and are scattered on the steep slopes. Fine sandy loam and loam materials mixed with sandstone fragments and quartz pebbles are between these boulders.

In the areas that developed in caliche, Rough broken land consists of a nearly vertical caprock escarpment, of caliche rock outcrops, and of steep land below the escarpment; a hardened caliche layer generally appears as a ledge near the top of these areas (fig. 12).

Included with this land type in mapping are small areas of Vernon soils, Latom fine sandy loam, Badland, and Potter soils.

The topography of this land type is a result of geological erosion, which is still active. Runoff is rapid to very rapid. Some slopes are so steep that they are inaccessible to cattle and horses. This, and the rough topography, makes these areas difficult to manage. A number of good grasses are grown, but the stands are thin. (Capability unit VIIs-2; Rough Breaks range site)

Spade Series

The Spade series consists of moderately rapidly permeable soils that are moderately deep over sandstone on uplands.

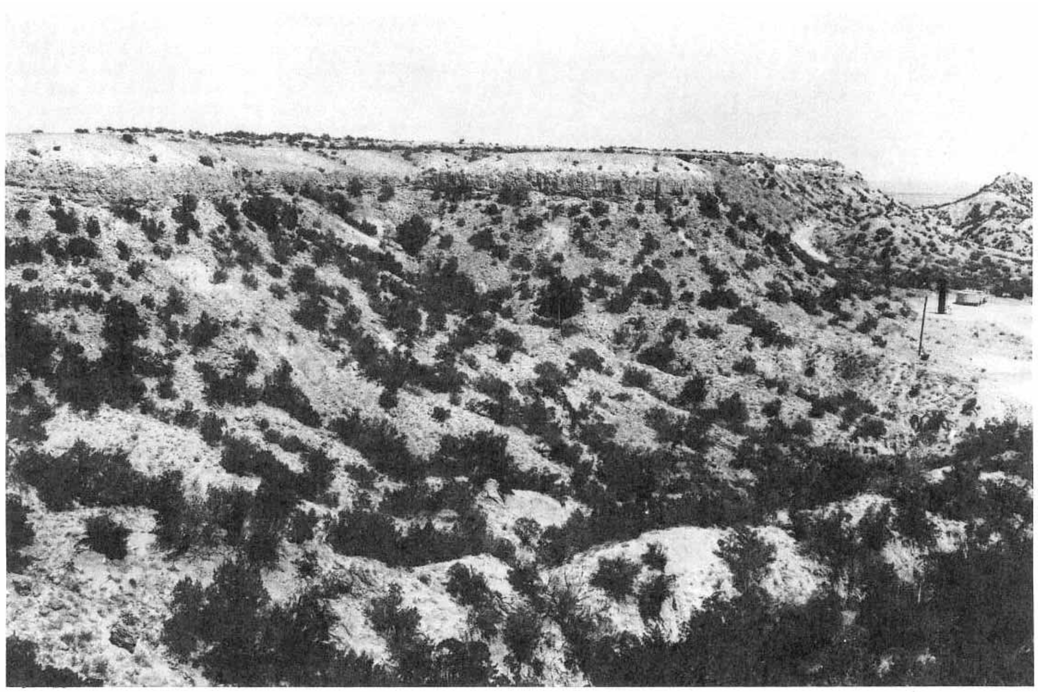


Figure 12.—Area of Rough broken land along the High Plains escarpment.

In a representative profile, the surface layer is brown, calcareous fine sandy loam about 8 inches thick. The next layer is friable fine sandy loam. It is light brown in the upper 16 inches and is light gray and contains about 5 percent calcium carbonate accumulation in the lower 8 inches. Light-gray, calcareous sandstone is at a depth of 32 inches.

These soils are well drained and have a moderate available water capacity. Hazard of soil blowing is moderate.

Representative profile of a Spade fine sandy loam in an area of Spade and Veal fine sandy loams, 3 to 5 percent slopes, 0.8 mile east and 0.4 mile north of the southwest corner of section 1218, located 2.25 miles north on Farm Road 122 from the intersection of Farm Road 122 and U.S. Highway 380 in Post:

A1—0 to 8 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; slightly hard, friable; many worm casts; many pores; few quartz pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

B21—8 to 24 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; hard, friable; many worm casts; many pores; few films and threads and fine concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—24 to 32 inches, light-gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; weak, fine, subangular blocky structure hard, friable; common, fine and very fine, soft masses and concretions of calcium carbonate, about 5 percent by volume; calcareous; moderately alkaline; clear, wavy boundary.

R—32 to 48 inches +, light-gray (5Y 7/2) weakly cemented sandstone, light olive gray (5Y 6/2) moist; massive (structureless); few, fine, soft masses of calcium carbonate; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 5 to 10 inches, and color is brown to dark grayish brown. The B21 horizon ranges in texture from fine sandy loam to loam, in color from reddish-brown to pale brown, and in thickness from 8 to 26 inches. Structure is subangular blocky or prismatic. Thickness of the B22ca horizon ranges from 2 to 12 inches, and color is light gray to pinkish gray. Depth to the R layer ranges from 20 to 48 inches, and it ranges from weakly cemented to strongly cemented sandstone. Color is reddish-brown to olive gray and light gray.

Spade and Veal fine sandy loams, 1 to 3 percent slopes (SeB).—The soils in this undifferentiated unit are convex and are on low ridges and knobs. Areas of these soils range in size from 5 to 200 acres. Some areas are Spade fine sandy loam, some are Veal fine sandy loam, and some are both. Small rills and gullies are in some areas, and sheet erosion has thinned the surface layer on the upper slopes of a few fields. Soil blowing has removed some of the fine particles from the surface layer.

Spade fine sandy loam is about 50 percent of this mapping unit. The surface layer is brown, friable, calcareous fine sandy loam about 10 inches thick. The next layer is friable, calcareous fine sandy loam. It is reddish-brown in the upper 16 inches; in the lower 7 inches, it is light gray and contains about 5 percent calcium carbonate. Weakly cemented, light-gray sandstone is at a depth of 23 inches.

Veal fine sandy loam is about 30 percent of this mapping unit. The profile of this soil is the one described as representative for the series.

About 20 percent of this mapping unit is inclusions. These are Miles fine sandy loam, Mobeetie fine sandy loam, Vernon soils, Latom fine sandy loam, sandstone and red-bed outcrops, and a soil similar to Spade soils that has a sandy clay loam texture below the surface layer.

About 25 percent of the acreage of these soils is cultivated, and the rest is in rangeland. The hazard of water erosion is slight. (Capability unit IIIe-8, dryland; Sandy Loam range site)

Spade and Veal fine sandy loams, 3 to 5 percent slopes (SeC).—The soils in this undifferentiated unit are on ridges, hilltops, and hillsides. Areas of these soils range in size from 5 to 75 acres. Some areas are Spade fine sandy loam, some are Veal fine sandy loam, and some are both. A few shallow gullies are in some areas. Sheet erosion and winnowing of the fine particles by soil blowing has thinned the surface layer a few inches in some fields.

Spade fine sandy loam is about 55 percent of this mapping unit. The profile of this soil is the one described as representative of the series.

Veal fine sandy loam is about 30 percent of this mapping unit. The surface layer is brown, calcareous fine sandy loam about 8 inches thick. The next layer is light reddish-brown, friable sandy clay loam about 12 inches thick. The underlying material is pink sandy clay loam that contains about 35 percent calcium carbonate in the upper 14 inches and about 15 percent calcium carbonate in the lower part.

About 15 percent of this mapping unit is inclusions. These are small areas of Miles fine sandy loam, Mobeetie fine sandy loam, Vernon soils, Latom fine sandy loam, and a soil similar to Spade soils that has a sandy clay loam texture below the surface layer.

About 20 percent of the acreage of this unit is cultivated. The rest is in rangeland. The hazard of water erosion is moderate. (Capability unit IVe-5, dryland; Sandy Loam range site)

Springer Series

The Springer series consists of deep, moderately rapidly permeable soils on uplands. The Springer soils are mapped only in a complex with Miles loamy fine sand.

In a representative profile, the surface layer is brown loamy fine sand about 16 inches thick. The next layer is reddish-brown, friable fine sandy loam about 22 inches thick. The underlying material is loamy fine sand to a depth of 64 inches. It is yellowish red in the upper 18 inches and light reddish-brown in the lower 8 inches.

These soils are well drained and have low available water capacity.

Representative profile of a Springer loamy fine sand in an area of Miles-Springer loamy fine sands, 3 to 5 percent slopes, located 200 feet east of a ranch road from a point that is 0.4 mile south of U.S. Highway 380, through the cattle guard, located 14 miles east on U.S. Highway 380 from its intersection with U.S. Highway 84:

A1—0 to 16 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; single grain (structureless); loose; neutral; clear, smooth boundary.

B2t—16 to 38 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish-brown (5YR 4/4) moist; weak, very coarse, prismatic structure; hard, friable; many worm casts; many fine pores; few, very thin, patchy clay films; neutral; gradual, smooth boundary.

C1—38 to 56 inches, yellowish-red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; weak, very coarse, prismatic structure; slightly hard, very friable; few fine pores; neutral; gradual, smooth boundary.

C2—56 to 64 inches +, light reddish-brown (5YR 6/4) loamy fine sand, reddish-brown (5YR 5/4) moist; massive (structureless); slightly hard, very friable; neutral.

Thickness of the A horizon ranges from 10 to 20 inches, and color is reddish-brown to brown. The B2t horizon ranges in thickness from 10 to 30 inches, in color from reddish-brown to red, and in texture from fine sandy loam to loamy fine sand. Depth to the C horizon is from 20 to 50 inches. It ranges in color from reddish-yellow to yellowish red and has a texture of loamy fine sand to fine sand.

Spur Series

The Spur series consists of deep, moderately permeable soils on bottom lands.

In a representative profile, the surface layer is dark-brown, calcareous clay loam about 16 inches thick. The next layer is reddish-brown, firm clay loam about 18 inches thick. The underlying material to a depth of 64 inches is reddish-brown loam that is stratified with thin layers of fine sandy loam.

These soils are well drained and have a high available water capacity. They receive extra water from floods or from runoff from nearby soils on uplands.

Representative profile of Spur clay loam 150 feet south in rangeland from the cattle guard, on a county road 1.75 miles east of a county road from Farm Road 122, from a point that is 11.8 miles north on Farm Road 122, from the junction of U.S. Highway 380 and Farm Road 122 in Post:

A1—0 to 16 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure; hard, firm; common worm casts; common fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

B2—16 to 34 inches, reddish-brown (5YR 5/4) clay loam, reddish-brown (5YR 4/4) moist; moderate, fine, subangular blocky structure parting to weak, coarse, prismatic structure; hard, firm; many worm casts; many fine pores; few threads and films and very fine soft masses of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

IIC—34 to 64 inches +, reddish-brown (5YR 5/4) loam, reddish-brown (5YR 4/4) moist; massive (structureless); hard, friable; few threads and films of calcium carbonate; stratified with thin layers of fine sandy loam; calcareous; moderately alkaline.

Thickness of the A1 horizon ranges from 11 to 20 inches, and texture is fine sandy loam to clay loam. Color ranges from dark grayish brown to brown, and structure is weak to moderate and granular, subangular blocky, or prismatic. The B2 horizon ranges in thickness from 12 to 35 inches, in texture from loam to clay loam, and in color from dark brown to reddish-brown. Depth to the C horizon is 23 to 55 inches. It is fine sandy loam to clay loam.

Spur clay loam (Sp).—This nearly level soil is on the flood plains of most of the rivers, creeks, and drainageways. Areas of this soil are generally long and relatively narrow and range in size from 10 to 200 acres. There is some deposition of recent soil material from upland slopes or from streams that dissect the areas. Slopes are dominantly less than 0.7 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are a few small areas of Olton clay loam, Abilene clay loam, Bippus loam, Berda loam, and Spur fine sandy loam.

Less than 5 percent of the acreage of this soil is cultivated, and the rest is in rangeland. This soil is subject to occasional flooding, but floods are of short duration. The hazard of soil blowing is slight. (Capability unit IIce-1, dryland; Loamy Bottomland range site)

Spur fine sandy loam (Su).—This nearly level soil is on flood plains along some of the major streams. Areas of this soil range from 10 acres to more than 200 acres in size. They generally are parallel to the streams and are 20 to 60 feet above the stream floor. These areas are seldom flooded. When they are flooded, however, there is little damage because water stands for only a short period of time.

The surface layer is brown, calcareous fine sandy loam about 18 inches thick. The next layer is reddish-brown, calcareous sandy clay loam about 20 inches thick. The underlying material is reddish-brown, calcareous clay loam that has a few thin layers of fine sandy loam.

Included with this soil in mapping are a few small areas of Spur clay loam, Mobeetie fine sandy loam, and Bippus loam. Also included are a few areas of soils that have a loamy fine sand surface layer.

About 75 percent of the acreage of this soil is cultivated, and the rest is in rangeland. The hazard of soil blowing is moderate. (Capability unit IIIe-4, dryland; Loamy Bottomland range site)

Tivoli Series

The Tivoli series consists of deep, rapidly permeable soils on uplands.

In a representative profile, the surface layer is brown fine sand about 7 inches thick. The underlying material to a depth of 60 inches is pale-brown, loose fine sand.

These soils are excessively drained and have low available water capacity.

Representative profile of Tivoli fine sand located 1,600 feet northeast of the north end of the Brazos River bridge, about 12.3 miles south of Post on Farm Road 669:

A1—0 to 7 inches, brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grain (structureless); loose; calcareous; moderately alkaline; diffuse, smooth boundary.

C—7 to 60 inches +, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain (structureless); loose; calcareous; moderately alkaline.

Thickness of the A1 horizon ranges from 5 to 11 inches, color from brown to light brown or pale brown, and reaction from neutral to moderately alkaline. Color of the C horizon ranges from light yellowish brown to pink.

Tivoli fine sand (Tv).—This soil is on dunes and ridges and makes up the area of long, narrow ridges and dunes along the river banks (fig. 13) and the dune areas on upland plains. Most areas are 5 to 40 acres in size, but a few are as large as 200 acres. Slopes range from 5 to 30 percent. The profile of this soil is the one described as representative of the series.

Included with this soil in mapping are small areas of Brownfield fine sand and Nobscot fine sand between dunes. A few small areas of Lincoln soils and blowout areas from 30 to 100 feet in diameter are also included.

All of the acreage of this soil is in rangeland. Erosion is not serious except on barren surfaces. Runoff is very slow. (Capability unit VIIe-1, dryland; Deep Sand range site)

Figure 13.—Area of Tivoli fine sand on dunes above area of Lincoln soils in the foreground.

Tivoli-Brownfield soils, rolling (Tw).—The soils in this complex are in formerly cultivated fields that range in size from 10 to 250 acres. These areas have been subject to soil blowing. In some places soil material has been removed, and in other places it has accumulated. The accumulation areas are dunes of Tivoli fine sand 1 to 6 feet high and 20 feet to several hundred feet across. Slopes range from 1 to 10 percent but are dominantly about 5 percent.

Tivoli soils are about 50 percent of this mapping unit. The surface layer is light-brown fine sand about 5 inches thick. The underlying material is light-brown, loose fine sand.

Brownfield soils are about 35 percent of this mapping unit. The surface layer is pale-brown fine sand about 25 inches thick. The next layer is yellowish-red sandy clay loam about 36 inches thick. The underlying material is yellowish-red fine sandy loam.

Included with this unit in mapping are small areas of Nobscot fine sand and small areas of soils where yellowish-red sandy clay loam is exposed.

Where this complex is unprotected by vegetation, the hazard of soil blowing is severe. These areas are best suited to range. (Capability unit VIIe-1, dryland; Deep Sand range site)

Veal Series

The Veal series consists of deep, moderately permeable soils on uplands. The Veal soils are mapped only in an undifferentiated unit with Spade fine sandy loam.

In a representative profile, the surface layer is brown, calcareous fine sandy loam about 8 inches thick. The next layer is light-brown, friable sandy clay loam about 10 inches thick. The underlying material to a depth of 48 inches is pink clay loam that has about 35 percent calcium carbonate in the upper 14 inches and about 15 percent calcium carbonate in the lower 16 inches.

These soils are well drained and have a moderate available water capacity.

Representative profile of a Veal fine sandy loam in an area of Spade and Veal fine sandy loams, 1 to 3 percent slopes, 180 feet south of Farm Road 211 in a pasture from a point that is 1.7 miles east on Farm Road 211 from the intersection of U.S. Highway 84 and Farm Road 211, about 10 miles northwest of Post:

A1—0 to 8 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; moderate, fine, granular structure; soft, very friable; common worm casts; calcareous; moderately alkaline; clear, smooth boundary.

B2—8 to 18 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; moderate, very coarse, prismatic structure parting to weak, fine, subangular blocky structure; slightly hard, friable; many worm casts; many pores; many films and threads, and common, medium to fine concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C1ca—18 to 32 inches, pink (5YR 7/3) clay loam, reddish-brown (5YR 5/3) moist; weak, fine, subangular blocky structure; hard, friable; many, fine and medium, soft masses and concretions of calcium carbonate, about 35 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

C2—32 to 48 inches +, pink (5YR 7/3) clay loam, reddish-brown (5YR 5/4) moist; massive (structureless); hard, friable; common, medium to fine concretions of calcium carbonate, about 15 percent by volume; calcareous; moderately alkaline.

The A horizon ranges in thickness from 5 to 10 inches, and structure is granular or subangular blocky. The B2 horizon ranges from 8 to 15 inches in thickness, and color is brown to light reddish-brown. Structure is weak or moderate and subangular blocky or prismatic, and texture ranges from loam to sandy clay loam.

Thickness of the C1ca horizon ranges from 10 to 24 inches, color is light reddish-brown to pink, and calcium carbonate content is about 15 to 40 percent. The C2 horizon is light reddish-brown to pink and contains from 10 to 20 percent calcium carbonate. Texture of the C horizon is clay loam to sandy clay loam.

Vernon Series

The Vernon series consists of moderately deep, very slowly permeable soils on uplands.

In a representative profile, the surface layer is reddish-brown clay loam about 7 inches thick. The next layer is reddish-brown, very firm clay about 11 inches thick. The underlying material to a depth of 40 inches is weak, red, partially weathered red-bed clay.

These soils are well drained and have a moderate available water capacity.

Representative profile of a Vernon clay loam in an area of Vernon soils, 1 to 3 percent slopes, located 0.3 mile southwest across the railroad in rangeland, from a point that is 7.5 miles southeast on U.S. Highway 84 from the intersection of U.S. Highways 84 and 380 in Post:

A1—0 to 7 inches, reddish-brown (5YR 4/4) clay loam, dark reddish-brown (5YR 3/4) moist; weak, medium, granular structure; hard, friable; many fine pores; common worm casts; common fine to coarse quartzite pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

B2—7 to 18 inches, reddish-brown (2.5YR 4/4) clay, dark reddish-brown (2.5YR 3/4) moist; moderate, medium, blocky structure; extremely hard, very firm; few pores; common fine to coarse quartzite pebbles; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

C—18 to 40 inches +, weak-red (10R 4/4) clay, dusky red (10R 3/4) moist; massive (structureless); extremely hard, very firm; partially weathered red beds; stratified and speckled with olive-gray (5Y 5/2) shaly clay; calcareous; moderately alkaline.

The A1 horizon ranges from 5 to 9 inches in thickness and from clay loam to clay in texture. Color is reddish-brown to brown, and structure is granular or blocky. The B2 horizon ranges from 6 to 16 inches in thickness. Color ranges from reddish-brown to red and texture from clay loam to clay. In places, there is a weakly developed Cca horizon at a depth between 8 and 20 inches. The C horizon is redbed shale, clayey sandstone, or shaly clay.

Vernon soils, 1 to 3 percent slopes (VeB).—These soils are on convex ridges and foot slopes. Areas of these soils are irregular in shape and range from 10 acres to several hundred acres in size. In some areas water erosion has cut a few gullies 1 to 5 feet deep and 1 to 30 feet wide. Slopes are dominantly about 2 percent. These soils have a profile similar to the one described as representative for the series, but the texture of the surface layer ranges from clay loam to clay.

Included with these soils in mapping are small areas of Dalby clay, Olton clay loam, Berda loam, Bippus loam, and Spade fine sandy loam. Also included are small outcroppings of red beds and sandstone and some areas in which the soil has a well-developed layer of calcium carbonate accumulation.

Most of the acreage of these soils is in rangeland. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. (Capability unit IVe-7, dryland; Shallow Redland range site)

Vernon soils, 3 to 5 percent slopes (VeC).—These soils are on convex and plane ridges and hillsides. Areas of these soils are irregular in shape and range in size from 10 acres to several hundred acres. Water erosion down old roads or trails has formed a few gullies 1 to 3 feet deep and 2 to 30 feet wide. Slopes are dominantly 3 to 4 percent.

The surface layer is reddish-brown, calcareous clay loam about 5 inches thick. The next layer is reddish-brown, very firm clay about 10 inches thick. The underlying material is calcareous, red-bed clay and shale.

Included with these soils in mapping are small areas of Olton clay loam, Dalby clay, Berda loam, Bippus loam, Latom fine sandy loam, Spade fine sandy loam, and Mobeetie fine sandy loam. Also included are small outcroppings of red beds and sandstone and a few areas of soils that have a well-developed layer of calcium carbonate accumulation.

Most of the acreage of these soils is in rangeland, but a small amount is in cultivation. These soils are best suited to use as range. (Capability unit VIe-1, dryland; Shallow Redland range site)

Vernon-Badland complex, hilly (Vb).—This complex consists of irregularly shaped areas that have been geologically eroded (fig. 14). Runoff water is carried quickly from these areas because of well-defined drainage patterns. Areas are from 20 to 100 acres in size. Relief ranges from about 30 feet to as much as 75 feet.

Figure 14.—Typical area of the Vernon-Badland complex.

The Vernon soils are about 35 percent of this complex. The surface layer is reddish-brown clay loam about 5 inches thick. The next layer is reddish-brown, very firm clay about 8 inches thick. The underlying material is calcareous red-bed clay and shale.

The Vernon soils are below the badland ridges and knobs. Slopes range from 2 to 30 percent but dominantly are about 4 percent. These soils are moderately deep and very slowly permeable. Quartz pebbles or sandstone and conglomerate fragments are scattered on the surface. Only about 5 to 15 percent of the ground is covered by grasses. Scattered small trees and other undesirable vegetation grow on these soils.

Badland is about 30 percent of this complex. It consists of barren knobs and ridges scattered throughout the area and of barren escarpments and ridges around part of the perimeter. Badland has very little vegetation and supports mostly woody plants.

The remaining 35 percent of this complex is inclusions of recent alluvial deposits of loam to gravelly sandy clay loam over silt loam or clay loam, of Dalby clay, and of areas of Rough broken land.

Areas of this complex have only a moderate potential for grazing. Careful management is needed to protect the vegetative cover on the soils and to prevent the areas of Badland from enlarging. (Capability unit VIIs-1, dryland; Shallow Redland range site)

Vernon complex, hilly (Vh).—The soils in this complex are on convex slopes along broad ridges and on concave slopes along major drainageways. Geological erosion is active and has dissected areas of these soils with deep gullies, steep slopes, and a well-defined drainage system. Except for gullies and exposed red beds, the slopes are smooth and well vegetated. The occurrence and pattern of the soils are erratic and differ from one area to the next. Areas are irregular in shape and are about 50 to 100 acres in size. Slopes are from 2 to 35 percent but are dominantly less than 20 percent. Local relief ranges from about 25 to 75 feet.

The Vernon soils are about 52 percent of this complex. These are moderately deep, very slowly permeable soils. Clay loam is the dominant texture. The Vernon soils are smoothly sloping and are below steeper areas on convex ridges between the small drains. Slopes are dominantly about 8 percent. Only about 4 to 10 percent of the ground is covered by grasses. Quartzite pebbles, 1 to 3 inches or more in diameter, are scattered on the surface.

Spade fine sandy loam and a gravelly fine sandy loam soil make up about 36 percent of this complex. These soils lie along ridges of caprock or conglomerates, on foot slopes that have a thin mantle from 1 foot to several feet thick over red beds, and in concave areas along drainageways. Slopes are dominantly about 10 percent. Only 3 to 10 percent of the ground is covered by grasses.

Inclusions that make up about 12 percent of this complex are areas of sandstone outcrops, clayey and shaly red-bed outcrops, Latom fine sandy loam, Olton clay loam, Bippus loam, Potter soils, and Dalby clay.

All of the acreage in this complex is in rangeland, but the total amount of useable forage is low. Most areas of this complex have a few trees and other woody vegetation. (Capability unit VIe-1, dryland; Shallow Redland range site)

Yahola Series

The Yahola series consists of deep, moderately rapidly permeable soils on bottom lands. The Yahola soils are mapped only in a complex with the Lincoln soils.

In a representative profile, the surface layer is reddish-brown, calcareous fine sandy loam about 7 inches thick. The underlying material to a depth of 30 inches is reddish-brown silt loam. Below this, to a depth of 48 inches, is stratified, reddish-yellow loamy fine sand.

These soils have a moderate available water capacity and are well drained.

Representative profile of a Yahola fine sandy loam in an area of the Lincoln-Yahola complex 0.1 mile west of a point that is 1.4 miles south of the intersection of Farm Road 2008 and U.S. Highway 380, 11 miles east on U.S. Highway 380 from the intersection of Farm Road 122 and U.S. Highway 380 in Post:

A1—0 to 7 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish-brown (5YR 4/4) moist; massive (structureless); soft, very friable; calcareous; moderately alkaline; gradual, smooth boundary.

C1—7 to 30 inches, reddish-brown (5YR 5/4) silt loam, dark reddish-brown (5YR 3/4) moist; weak, fine, granular structure; slightly hard, friable; few thin strata of very fine sandy loam up to 1/2 inch thick; calcareous; moderately alkaline; clear, smooth boundary.

C2—30 to 48 inches +, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; massive (structureless); loose; strata of fine sand; calcareous; moderately alkaline.

Thickness of the A horizon ranges from 6 to 20 inches, color from brown to red, and texture from fine sand to clay loam. The C horizon ranges in color from light brown to red. This horizon is stratified with layers that range from fine sand to clay in texture. The mixed texture is sandy loam.

Zita Series

The Zita series consists of deep, moderately permeable soils on uplands.

In a representative profile, the surface layer is dark-brown, neutral loam and clay loam about 16 inches thick. The next layer is light brownish-gray, calcareous clay loam about 16 inches thick. The underlying material to a depth of 60 inches is calcareous, friable clay loam that is pink and contains about 50 percent calcium carbonate in the upper 16 inches and is very pale brown and contains about 15 percent calcium carbonate in the lower part.

These soils are well drained. The available water capacity is high.

Representative profile of Zita loam, 0 to 1 percent slopes, located 100 feet south in a cultivated field from a point that is 1,600 feet west of Farm Road 1313, from a point that is 1 mile south on Farm Road 1313 from the intersection of Farm Road 1313 and U.S. Highway 380 near Storie Gin, about 9 miles west of Post:

Ap—0 to 7 inches, dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; soft, friable; neutral; abrupt, smooth boundary.

A1—7 to 16 inches, dark-brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; slightly hard, friable; many worm casts; many fine pores; neutral; gradual, smooth boundary.

B2—16 to 32 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate, fine, subangular blocky structure; slightly hard, friable; common fine pores; common worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—32 to 48 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; massive (structureless); hard, friable; fine to medium, soft masses and concretions of calcium carbonate, about 50 percent by volume; calcareous; moderately alkaline.

C2—48 to 60 inches +, very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; massive (structureless); hard, friable; medium to very fine soft masses and concretions of calcium carbonate, about 15 percent by volume; calcareous; moderately alkaline.

Thickness of the A horizon is 11 to 20 inches, and color ,ranges from dark brown to dark grayish brown. Thickness of the B2 horizon is from 6 to 20 inches, color is grayish brown to light brown, and texture is loam to clay loam. Structure is weak or moderate. Depth to the C1ca horizon is 20 to 40 inches. Thickness ranges from 10 to 25 inches, and color is very pale brown, pink, or white. It contains from 30 to 60 percent calcium carbonate. The C2 horizon contains from 5 to 20 percent calcium carbonate.

Zita loam, 0 to 1 percent slopes (ZtA).—This soil is on benches around playas. Areas are from 8 to 70 acres in size. Most slope gradients are about 0.6 percent.

Included with this soil in mapping are small areas of Portales loam, Lubbock clay loam, and Acuff loam.

All the acreage of this soil is cultivated, and most of it is irrigated. Some sheet erosion and deposition of soil material occur as water flows onto or across this soil after high-intensity rains. This soil has a high available water capacity. Hazard of soil blowing is slight. Runoff is very slow. (Capability unit IIIce-2, dryland, and I-2 irrigated; Deep Hardland range site)

USE AND MANAGEMENT OF THE SOILS

This section discusses soil blowing and its control, irrigation, and the system of capability classification used by the Soil Conservation Service. Then it explains management by capability units for both dryland and irrigated soils. Next it gives estimated yields per acre for dryland and irrigated soils. Finally, it discusses the use and management of the soils for range, wildlife, and engineering.

Soil Blowing and Its Control

No farm in Garza County is safe from the threat of damage caused by high winds. The hazard of soil blowing therefore has a major influence on soil management. Effective control of soil blowing requires the cooperation of all farmers in an area, because the soil materials blown from unprotected fields damage the soils on adjoining fields.

Effects of soil blowing.—The effects of soil blowing are serious and extensive in Garza County. Many crops are lost, and soil fertility is greatly reduced. Insects and weed seeds are blown far and wide, and fences, hedges, and shelterbelts are sometimes ruined. The most serious effect of soil blowing is the loss of fine soil particles such as silt, clay, and organic matter, which are gradually sorted and moved to distant places. The wind acts like a sieve on soils. It leaves the coarse particles but removes the fine particles that enable a soil to furnish food to plants.

In areas of Brownfield fine sand and Miles loamy fine sand, large dunes accumulate around windbreaks, fences, or farm buildings and homes. In cultivated fields, dunes as much as 20 feet high are common along fence rows. In places, abandoned fields have lost all of the thick, sandy surface layer. Blowing of sterile sand from these fields onto adjacent areas of more productive soils is particularly damaging.

Soil blowing has had the most drastic effects on Miles loamy fine sand and Brownfield fine sand. In cultivated areas farmers may have to roughen the surface of these soils with tillage implements several times in a single season. Even a light rain is likely to break up the clods, and then the soil blows and drifts severely. Constant care and maximum use of crop residue are required to reduce erosion on these soils.

The finer textured soils, which include Olton loams, Acuff loams, Olton clay loams, and Abilene clay loam, are least affected by soil blowing because tillage generally roughens and clods them so that they can resist blowing. In most areas, however, winnowing by wind has removed enough of the organic matter, silt, and clay from the surface soil to make it coarser textured than when first cultivated. Thus, these soils become more susceptible to erosion, have less capacity to hold water and plant nutrients, and are more likely to form plowpans.

The same effects of soil blowing also appear in most cultivated areas of Amarillo fine sandy loam and Miles fine sandy loam. If these soils are not protected, soil blowing removes most of the organic matter, silt, and clay from the surface layer. The remaining sandy layer lacks plant food and is susceptible to soil blowing. To offset these effects, farmers have plowed deeper to bring up the more clayey underlying material. In many areas this process has been repeated so often that the surface layer, to a depth of 10 to 12 inches, has changed from fine sandy loam to loamy fine sand.

Rangeland in Garza County also shows the effects of soil blowing. In some places the soil is shifted or removed by wind, but generally it is blown onto the rangeland from cultivated areas. In places 6 inches to several feet of sand covers several acres. In these areas good grasses are smothered.

One of the least noticeable yet most damaging effects of soil blowing is the blowing of clay and silt from cultivated land onto rangeland. Materials picked up by wind from cultivated areas are carried many miles before being deposited on rangeland in a mantle $^{1}/_{8}$ to ½ inch thick. This mantle is almost impervious to water and thus increases runoff and water erosion.

Control of soil blowing.—Control of soil blowing depends on conserving the clay and organic matter in soils. When soil blowing takes place, so much fine material is eventually lost that there is not enough clay to produce clods.

The rougher the surface, the greater the wind velocity needed to start soil blowing. Roughness of a field depends on the height, spacing, and type of vegetative cover on the soil. It also depends on the size, shape, and spacing of clods, ridges, and ripples. For example, listing has long been depended on to help control soil blowing (fig. 15). The effectiveness of listing depends mainly on whether enough clay and moisture are in the soil to produce clods and on the amount of stalk or stubble left standing in the beds. If the listing has produced a rough surface, it is effective.

Figure 15.—Area of Olton loam, 0 to 1 percent slopes, that has been listed to roughen the surface and control soil blowing.

The best way to control soil blowing is by maintaining a vegetative cover or by properly managing crop residue, which helps to slow down the wind at the ground surface. Standing stubble reduces wind velocity more than flattened stubble, and close-spaced stubble reduces it more than the same amount of wide-spaced stubble.

Some areas in Garza County have eroded to the extent that they are no longer cultivated. Unless soil blowing is controlled, many other areas will eventually erode to the same degree.

Irrigation

In Garza County about 15,000 acres are irrigated, and most of this acreage is on the High Plains; however, sufficient water for irrigation is not available in all areas on the High Plains. The supply of irrigation water is generally limited and comes from wells that are 50 to 200 feet deep. In 1965 some 490 wells were supplying water for irrigation in the county.

The purpose of irrigation is to make it possible to apply water in the needed amounts at the right time and to distribute the water uniformly (fig. 16). A properly designed irrigation system efficiently uses the available water and helps to maintain or increase the productivity of the soils. It does not cause erosion, waterlogging, or excessive leaching of plant nutrients.

The factors that must be considered in designing an irrigation system are the quality and quantity of the available water, the rate that the soils take water and the amount of water they will hold, the water needs of the crops to be grown, and the topography of the area to be irrigated.

Figure 16.—Uneven distribution of irrigation water caused this uneven growth of cotton on Olton loam, 0 to 1 percent slopes.

There are two main types of irrigation systems, sprinkler (fig. 17) and surface (fig. 18). The sprinkler system is better suited to sandy and shallow soils and to soils having complex slopes that cannot be leveled economically. Terracing and contour farming to control erosion are advisable on some sprinkler-irrigated soils.

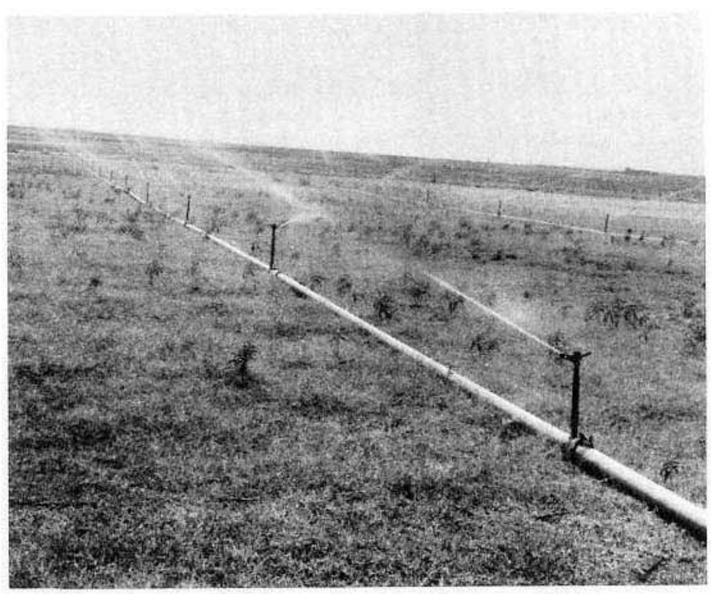


Figure 17.—Sprinkler irrigation of midland bermudagrass on Amarillo fine sandy loam, 0 to 1 percent slopes.

Figure 18.—Row irrigation of cotton on Olton loam, 0 to 1 percent slopes.

The surface irrigation system is suitable for deep, nearly level, loamy soils that take in water at a rate of less than 2 inches per hour, hold more than 1 inch of water per foot of depth, and have a slope of less than 1 percent. Water can be carried to the fields by underground pipes, portable pipes, or even in open ditches if seepage losses are not too great.

Regardless of the method of irrigation used, the design of the system is important. For surface irrigation, the amount of water applied, the time of application, and the length of the row run should be carefully planned. It is advisable to have an irrigation system designed by a qualified engineer to ascertain that the system will make the best use of the available water and will be suitable for the soils and crops. The local office of the Soil Conservation Service can assist farmers in designing irrigation systems.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.
Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.
Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion, unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Garza County are described and suggestions for the use and management of the soils are given. The units are not numbered consecutively, because a statewide system is used for numbering the capability units in Texas and not all of the units in the system are represented in this county. This does not mean, however, that all the soils of a series are in a given capability unit.

Capability Unit I-1, Irrigated

This unit consists of nearly level, deep, moderately slowly permeable to slowly permeable soils on uplands. Available water capacity is high. The hazard of soil blowing is slight, and the water-intake rate is low.

These soils are well suited to cultivation and irrigation. Cotton and grain sorghum are the main crops grown. In areas where cotton is grown continuously, a supplemental mulch, such as cotton burs, or a winter cover crop is helpful in controlling soil blowing and maintaining organic-matter content and soil fertility. As emergency measures, chiseling or listing can be used to help reduce soil blowing where inadequate residue is produced (fig. 19).

Figure 19.—Emergency tillage to help control soil blowing where the amount of residue is inadequate on Olton loam, 0 to 1 percent slopes.

Capability Unit I-2, Irrigated

This unit consists of nearly level, deep, moderately permeable soils on uplands. Available water capacity is high. The hazard of soil blowing is slight.

These soils are well suited to cultivation and irrigation. Grain sorghum and cotton are the most common crops grown. Residue from the grain sorghum needs to be managed on or near the surface to reduce the hazard of erosion. If cotton is grown continuously, a mulch, such as cotton burs, or a winter cover crop is helpful in maintaining productivity and controlling erosion. As emergency measures, chiseling or listing can be used to help reduce soil blowing where inadequate residue is produced.

Capability Unit IIe-1, Irrigated

The only soil in this unit is Acuff loam, 1 to 3 percent slopes. This is a deep, moderately permeable soil on uplands. Available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

This soil is suited to cultivation and irrigation. Grain sorghum and cotton are the main crops. Grain sorghum residue helps to control erosion and maintain productivity. Some of the residue should be kept on the surface during critical periods of soil blowing. Nitrogen fertilizer, if used, helps to decompose the residue and improve fertility.

Occasionally, emergency surface roughening by tillage is needed to reduce the hazard of soil blowing.

Capability Unit IIe-2, Irrigated

The only soil in this unit is Olton loam, 1 to 3 percent slopes. This is a deep, moderately slowly permeable soil on uplands. The available water capacity is high. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

This soil is suited to cultivation and irrigation. Cotton and grain sorghum are the main crops grown. Residue from the grain sorghum needs to be managed on or near the surface to reduce the hazard of erosion. If cotton is grown continuously, a supplemental mulch, such as cotton burs, or a winter cover crop is helpful in maintaining productivity and controlling erosion. Emergency tillage may be needed during critical periods to reduce the hazard of soil blowing.

Capability Unit IIe-3, Irrigated

The only soil in this unit is Portales loam, 0 to 1 percent slopes. This is a deep, moderately permeable, calcareous soil on uplands. The available water capacity is high. The hazard of soil blowing is moderate.

This soil is suited to cultivation and irrigation. Cotton and grain sorghum are the main crops grown. With proper management, grain sorghum produces large amounts of residue, which helps to prevent surface crusting and to reduce the hazard of erosion. Residue is most beneficial when left on or near the surface. If cotton is grown continuously, this soil may need a supplemental mulch, such as cotton burs, or a winter cover crop. When crop residue is inadequate, chiseling, listing, or other emergency tillage operations can be used to help reduce the hazard of soil blowing.

Capability Unit IIe-4, Irrigated

The only soil in this unit is Amarillo fine sandy loam, 0 to 1 percent slopes. This is a deep, moderately permeable soil on uplands. The available water capacity is high. The hazard of soil blowing is moderate.

This soil is suited to cultivation and irrigation. Cotton and grain sorghum are the main crops grown. With proper management, grain sorghum produces large amounts of crop residue. A mulch of cotton burs or a winter cover crop add needed residue to the soil. Maintaining crop residue on or near the surface helps to control soil blowing and to maintain organic-matter content and soil fertility. If crop residue is inadequate, chiseling, listing, or emergency surface roughening by tillage can be used to help reduce the hazard of soil blowing.

Capability Unit IIe-6, Irrigated

The only soil in this unit is Amarillo fine sandy loam, 1 to 3 percent slopes. This is a deep, well-drained, moderately permeable soil on uplands. The available water capacity is high. The hazards of water erosion and soil blowing are moderate.

This soil is suited to cultivation and irrigation. Cotton and grain sorghum are the main crops grown. If sorghum residue is produced in sufficient quantities, it will help to control erosion and maintain productivity. Some of the residue should be kept on the surface during critical periods of soil blowing. If crop residue is inadequate, chiseling, listing, or emergency surface roughening by tillage may be needed to reduce the hazard of soil blowing.

Capability Unit IIce-1, Dryland

The only soil in this unit is Spur clay loam. This is a deep, moderately permeable soil on bottom lands. The available water capacity is high. The hazard of soil blowing is slight.

This soil is suited to cultivation. Grain sorghum and cotton are the main crops grown. With proper management, grain sorghum produces large amounts of crop residue. If cotton is grown continuously, a mulch of cotton burs can be used to add needed residue to the soil. Crop residue managed on or near the surface reduces surface crusting and soil erosion. If crop residue is inadequate, emergency surface roughening by tillage may be needed to further reduce the hazard of soil blowing.

Capability Unit IIce-3, Dryland

The only soil in this unit is Claremont silt loam. This is a nearly level, deep, well-drained soil on bottom lands. The available water capacity is high. The hazard of soil blowing is slight.

This soil is suitable for cultivation. Cotton, grain sorghum, forage sorghum, and small grain are suited crops. Residue from these crops needs to be managed on the surface to control erosion. An emergency tillage practice such as listing or chiseling can be used to control the hazard of soil blowing where inadequate residue is produced.

Capability Unit IIce-4, Dryland

This unit consists of nearly level, deep, moderately slowly permeable soils on uplands. The available water capacity is high. The hazard of soil blowing is slight.

These soils are suited to cultivation, but most areas are in rangeland. Cotton is the main crop, but sorghum is also grown. Sorghum produces large amounts of residue. With good management, this residue helps to prevent surface crusting and to reduce the hazard of erosion. It is most effective when left on or near the surface. If cotton is grown, cotton burs are a good source of residue. Use of terraces and contour farming conserves moisture on these soils. If crop residue is inadequate, emergency surface roughening by tillage helps to reduce the hazard of soil blowing.

Capability Unit IIIe-2, Dryland

This unit consists of gently sloping, deep, well-drained, moderately permeable to moderately slowly permeable soils on uplands. Available water capacity is high. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

These soils are suited to cultivation, and large acreages are cultivated. Cotton and grain sorghum are the main crops grown. Some areas are in rangeland. Residue from the grain sorghum needs to be managed on the surface to prevent crusting and reduce the hazard of erosion. In areas where cotton is grown continuously, a mulch of cotton burs is helpful in maintaining productivity. As an emergency measure, surface roughening by tillage can be used to help reduce erosion where inadequate residue is produced. Terracing and farming on the contour help to reduce water erosion and conserve moisture (fig. 20).

Capability Unit IIIe-3, Dryland

The only soil in this unit is Portales loam, 1 to 3 percent slopes. This is a deep, moderately permeable, calcareous soil on uplands.

The available water capacity is high. The hazards of soil blowing and water erosion are moderate.

This soil is mostly in cultivation. Grain sorghum and cotton are the main crops grown. This soil needs careful management for good production. Crop residue needs to be managed on the surface to reduce the hazard of erosion. Where crop residue does not adequately protect the soil, emergency tillage, such as chiseling or listing, can be used to reduce the hazard of soil blowing. Terracing and farming on the contour help to reduce the hazard of water erosion and to conserve moisture.

Figure 20.—A terraced field, showing water retained on the soil after a hard rain on Olton loam, 1 to 3 percent slopes.

Capability Unit IIIe-4, Irrigated

The only soil in this unit is Portales loam, 1 to 3 percent slopes. This is a deep, well-drained, moderately permeable soil on uplands. The available water capacity is high. The hazards of soil blowing and water erosion are moderate.

This soil is suited to cultivation. Grain sorghum is the major crop. Some cotton is grown. Crop residue needs to be managed on the surface to prevent soil crusting and to reduce the hazard of erosion. If the residue does not adequately protect this soil, chiseling or listing can be used as an emergency measure to help reduce the hazard of soil blowing.

Capability Unit IIIe-4, Dryland

This unit consists of nearly level to gently sloping, deep, well-drained, moderately permeable soils on uplands. The available water capacity is high. The hazard of soil blowing is moderate, and the hazard of water erosion is slight to moderate.

These soils are suited to dryland cultivation. Cotton and grain sorghum are the main crops grown. Residue from the grain sorghum needs to be managed on the surface to help control erosion through critical periods of soil blowing (fig. 21). A mulch of cotton burs, a good source of residue (fig. 22), helps to maintain productivity. As an emergency measure, surface roughening by tillage can be used to help reduce erosion where residue is inadequate to provide protective cover. Terracing and farming on the contour help to reduce water erosion and to conserve moisture in the more sloping areas.

Capability Unit IIIe-5, Dryland

The only soil in this unit is Mobeetie fine sandy loam, 1 to 3 percent slopes. This is a deep, moderately rapidly permeable soil on uplands. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

This soil is suited to dryland cultivation, but most of it is in rangeland. Grain sorghum and cotton are the major crops grown. Crop residue needs to be managed on the surface to help reduce soil blowing. Cotton burs are also a good source of residue for protective cover. As an emergency measure, surface roughening by tillage can be used to provide a protective cover against soil blowing in dry years when inadequate residue is produced.

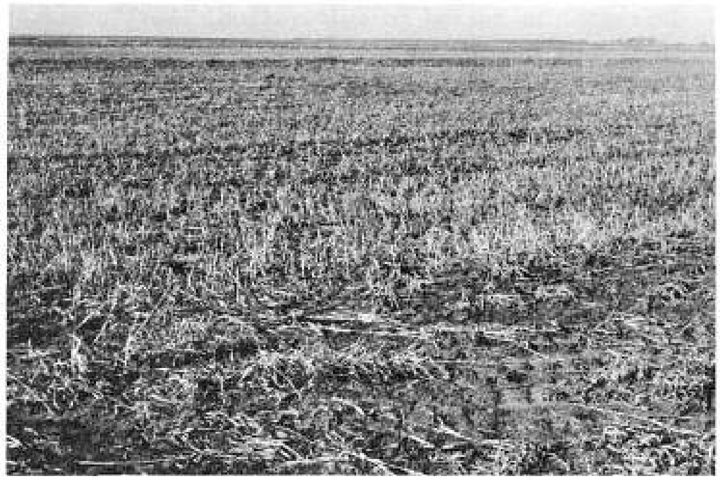


Figure 21.—Grain sorghum stubble sufficient to control soil blowing and water erosion on Miles fine sandy loam, 0 to 1 percent slopes.

Figure 22.—Cotton burs applied to an area of Miles fine sandy loam, 1 to 3 percent slopes, where crop residue was inadequate to protect the soil.

Capability Unit IIIe-8, Dryland

This unit consists of gently sloping, moderately deep to deep, moderately permeable to moderately rapidly permeable, well-drained soils on uplands. The available water capacity is moderate. The hazard of soil blowing is moderate, and the hazard of water erosion is slight.

These soils are suited to cultivation, but most of the acreage is in rangeland. Sorghum and cotton are the most common crops grown. Careful management is needed to keep all available residue on the surface during critical periods of soil blowing. Cotton burs are a good source of residue and help to control erosion and to keep the soils productive. If crop residue is not sufficient to protect the soils from blowing, chiseling or listing can be used as an emergency measure to give protection. Terraces and contour farming help to reduce the hazard of water erosion and to conserve moisture.

Capability Unit IIIe-10, Irrigated

This unit consists of nearly level and gently sloping, deep, moderately permeable, well-drained, calcareous soils on uplands. Available water capacity is high. The hazard of soil blowing is moderate. In gently sloping areas, the hazard of water erosion is moderate.

This soil is suited to cultivation. Cotton and grain sorghum are the main crops grown. If managed properly, grain sorghum produces large quantities of residue. Residue to control soil blowing should be left on or near the surface. Emergency tillage operations such as chiseling or listing can be used to help control soil blowing where crop residue is inadequate.

Capability Unit IIIce-2, Dryland

This unit consists of nearly level, deep, moderately permeable to slowly permeable soils on uplands. Available water capacity is high. The hazard of soil blowing is slight.

These soils are suited to cultivation. Cotton and grain sorghum are the main crops grown. Crop residue on or near the soil surface helps to maintain productivity and to give needed protection from soil blowing. Alternate strips of cotton and grain sorghum are sometimes planted to help reduce the hazard of soil blowing (fig. 23). As an emergency measure, surface roughening by tillage can be used during critical periods of soil blowing. Use of terraces conserves moisture and gives protection from water erosion.

Figure 23.—Grain sorghum and cotton planted in strips on Olton loam, 0 to 1 percent slopes.

Capability Unit IIIce-3, Dryland

The only soil in this unit is Portales loam, 0 to 1 percent slopes. This is a deep, moderately permeable, calcareous soil on uplands. The available water capacity is high. The hazard of soil blowing is moderate.

This soil is suited to cultivation. Grain sorghum and cotton are the main crops grown. Residue from the grain sorghum needs to be managed on or near the surface to protect this soil during critical periods of soil blowing, to help conserve moisture, and to keep this soil productive. Emergency surface roughening by tillage can be used to help reduce the hazard of soil blowing where crops and residue do not provide adequate protective cover.

Capability Unit IIIs-2, Dryland

The only soil in this unit is Dalby clay, 0 to 2 percent slopes. This is a deep, very slowly permeable soil on uplands. Available water capacity is high.

This soil is suited to cultivation. The most suitable crops are small grain and sorghum. The clay texture makes this soil difficult to manage. Residue on the surface helps to prevent crusting. Emergency measures such as chiseling or listing are effective in reducing soil blowing where crop residue is inadequate.

Capability Unit IVe-2, Dryland

This unit consists of gently sloping, deep, moderately permeable, calcareous soils on uplands. Available water capacity is high. The hazard of soil blowing is slight to moderate, and the hazard of water erosion is moderate to moderately severe.

This soil is suited to cultivation but is mostly in native range. Most of the cultivated areas are planted to forage sorghum, which produces residue. Where this residue is managed on the surface, it reduces soil blowing, water erosion, evaporation, and runoff. Where there is not enough residue to control soil blowing, it may be necessary to use emergency tillage or to apply cotton burs. Most cultivated areas need terraces and contour farming to control water erosion and conserve moisture.

Capability Unit IVe-4, Dryland

The only soil in this unit is Miles fine sandy loam, 3 to 5 percent slopes. This is a deep, moderately permeable soil on uplands. Available water capacity is high. The hazards of soil blowing and water erosion are moderate.

This soil is suited to cultivation. Most areas of this soil are in rangeland, but some are cropped to cotton and sorghum. Crop residue needs to be on or near the surface to help control erosion. Cotton burs are a good source of residue. If crops do not furnish adequate residue, emergency surface roughening by tillage can be used to help control soil blowing. Where excess runoff water is a problem, terraces and farming on the contour help to reduce the hazard of water erosion and to conserve moisture.

Capability Unit IVe-5, Dryland

This unit consists of gently sloping, moderately deep and deep, moderately permeable to moderately rapidly permeable, calcareous soils on uplands. The available water capacity is moderate. The hazards of soil blowing and water erosion are moderate.

These soils are suited to cultivation, but careful management is needed to control erosion. Most of the acreage of this unit is in rangeland. Sorghum is grown most extensively. Residue from the sorghum needs to be maintained on the surface as long as possible to reduce erosion and evaporation. If crop residue is insufficient, surface roughening by tillage can be used to help control soil blowing. Terracing and farming on the contour can be used to help prevent water erosion and to conserve moisture.

Capability Unit IVe-6, Dryland

The only soil in this unit is Miles loamy fine sand, 0 to 3 percent slopes. This is a deep, well-drained, moderately permeable soil on uplands. The available water capacity is high. The hazard of soil blowing is severe.

This soil is suited to cultivation. Cotton and forage sorghum are the main crops grown. This soil requires careful management to control erosion. Crop residue needs to be left on the surface to reduce the hazard of soil blowing and to reduce water runoff. Where crop residue is not sufficient to protect the soil, chiseling or listing can be used to help reduce the hazard of soil blowing. Plowing to a depth where one-fourth to one-third of the furrow slice is moderately fine textured material also helps to reduce the hazard of soil blowing. Terracing and farming on the contour may be needed on some slopes and where there is runoff water from higher slopes.

Capability Unit IVe-7, Dryland

This unit consists only of Vernon soils, 1 to 3 percent slopes. These are moderately deep, very slowly permeable soils on uplands. The available water capacity is moderate. The hazard of water erosion is moderate, and the hazard of soil blowing is slight. Runoff is rapid. These soils are droughty.

A few acres of these soils are cultivated, but most of the acreage is in range. Sorghum and cotton are the crops grown. Crop residue needs to be managed on the surface to help control erosion. Cotton burs are also a good source of residue and give similar benefits. Terraces are needed to help reduce the hazard of water erosion.

Capability Unit IVe-9, Dryland

This unit consists of nearly level to gently sloping, deep, well-drained, calcareous soils on uplands. The available water capacity is high. The hazard of water erosion in the gently sloping areas is moderate. The hazard of soil blowing is moderate.

This soil is suited to cultivation. Cotton and grain sorghum are the main crops grown. Residue from the grain sorghum needs to be managed on the surface to help reduce the hazard of erosion. The application of cotton burs to these soils also protects them from erosion. As an emergency measure, surface roughening by tillage can be used to reduce the hazard of soil blowing where crop residue is not sufficient to protect the soil. Terracing the gently sloping areas and farming on the contour are needed to conserve moisture and control water erosion.

Capability Unit IVes-1, Dryland

This unit consists of Drake soils, 2 to 5 percent slopes. These are deep, moderately permeable, well-drained, calcareous soils on uplands. Available water capacity is high. The hazard of soil blowing is severe. The hazard of water erosion is moderate. These soils are high in content of lime. Because of this, some plant nutrients, such as iron, are unavailable, which limits plant growth.

These soils are suited to cultivation if carefully managed. Grain sorghum is the main crop, but yellowing of plants is common in most areas. The management of crop residue on the surface during the year helps to reduce soil blowing and the hazard of water erosion. It also helps to maintain productivity. Terraces and contour farming are needed to control water erosion in areas where excess runoff water is a problem.

Capability Unit Vw-2, Dryland

This unit consists of deep, moderately rapidly permeable to rapidly permeable soils on bottom lands. These soils are subject to flooding during periods of high rainfall and rapid runoff. During these periods, scouring occurs and new material is deposited on the surface.

These soils are not suited to cultivation but are well suited to rangeland, wildlife, and recreation. They respond well to good management. Controlled grazing helps to keep the grass vigorous; however, some areas require idle periods to allow the grass to make seed. Brush control is needed in some areas.

Capability Unit VIe-1, Dryland

This unit consists of gently sloping to steep, moderately deep, well-drained soils on uplands. The hazard of water erosion is severe.

These soils are not suited to cultivation. Most of the acreage is in rangeland. The few areas in cultivation are better suited to perennial grasses than to cultivated crops. The chief management concern is to maintain an adequate cover of vegetation. Leaving about one-half of the grass on the surface each year keeps the grass in a vigorous condition and helps to control erosion. Some areas need brush control.

Capability Unit VIe-3, Dryland

This unit consists of gently sloping to steep, very shallow to deep, moderately permeable to moderately rapidly permeable, calcareous soils on uplands. The hazard of water erosion is severe. The available water capacity is low to moderate.

These soils are not suited to cultivation. Most of the acreage is in rangeland. The few areas in cultivation are better suited to perennial grasses than to cultivated crops. The chief management concern is to maintain an adequate cover of vegetation. Leaving about one-half of the grass on the surface each year keeps the grass in a vigorous condition and helps to control erosion. A few areas need brush control.

Capability Unit VIe-6, Dryland

This unit consists of gently sloping to sloping, deep, well-drained, moderately permeable to moderately rapidly permeable soils on uplands. The available water capacity is low to high. The hazards of water erosion and soil blowing are severe.

This soil is unsuitable for cultivation because of the slope and the hazard of erosion. Most of the acreage is in rangeland. The few areas in cultivation are better suited to perennial grasses than to cultivated crops. Controlled grazing, which maintains a good cover of grass at all times, keeps the grass vigorous and helps to control erosion and to conserve moisture. Brush needs to be controlled in some areas.

Capability Unit VIe-7, Dryland

This unit consists of level to gently sloping, deep, well-drained, moderately permeable to moderately rapidly permeable soils on uplands. The available water capacity is low.

Most of the acreage of these soils is in rangeland, but a few areas are cultivated or have been cultivated. These soils are suited to rangeland, recreation, and wildlife. They are not suited to dryland farming, because of the severe hazard of soil blowing. A good cover of vegetation needs to be maintained on these soils at all times to control soil blowing. Many of the previously cultivated fields need to be seeded to grass. The grass will be most vigorous if it is managed so that at least one-half of the annual growth remains on the surface. Many areas of these soils have a brush cover and need brush control.

Capability Unit VIw-1, Dryland

The only soil in this unit is Randall clay. This is a nearly level, deep, somewhat poorly drained soil on playas. Areas of this soil receive runoff from surrounding areas. The hazard of soil blowing is moderate when the surface is dry and bare.

Periodic flooding and ponding limit the use of this soil. During dry years, crops can be grown and harvested on this soil. Terracing and contour farming of adjacent soils help to reduce runoff onto areas of this soil. Because of the variability of this soil and the small areas involved, it is difficult to manage it alone. It is managed the same as the surrounding soils.

Capability Unit VIIe-1, Dryland

This unit consists of gently sloping to steep and duned, deep, moderately permeable to rapidly permeable soils on uplands. Available water capacity is low. Water intake is rapid. The hazard of soil blowing is severe.

These soils are too sandy or too steep for cultivation. They are suited to range, wildlife, and recreation. The soils in this unit need to be managed to control erosion. A good cover of vegetation is needed at all times. Grass needs to be protected from grazing and allowed to make seed. In some areas brush control may be needed.

Capability Unit VIIs-1, Dryland

This unit consists of nearly level to steep, very shallow to moderately deep, well-drained, calcareous, loamy soils on uplands. The available water capacity is low to moderate. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

These soils are too steep and too shallow for cultivation. All of the acreage is in range, but it is also suitable for recreation and wildlife. Careful management is needed to control erosion. Controlled grazing of these soils helps to keep the grass in a vigorous condition and to reduce the hazard of erosion.

Capability Unit VIIs-2 Dryland

This unit consists of Rough broken land. It is in rough, broken, and steep areas. Geological erosion is active.

Rough broken land is too steep and erodible to be cultivated. It is suitable only for limited grazing, for wildlife, and for recreation. Most areas of this land type have only a sparse cover of vegetation. It is not easily accessible to livestock and is usually grazed only when other food sources are depleted. Rough broken land needs treatment to maintain or improve the native vegetation. Grazing must be controlled in order to help keep the grass vigorous and healthy.

Capability Unit VIIIs-1, Dryland

This unit consists of Badland. It is made up of gently sloping to steep, clayey and shaly materials that in most places are bare of vegetation. Geological erosion is active.

Badland is suitable only for wildlife and recreation. Because this land type is highly erodible, it is difficult to maintain a cover of vegetation on it even under very careful management.

Crop Yields

Crop yields over a period of years reflect the management the soil has received. Generally, continued high yields are a result of good management and an indication that the soil has been improved or is being kept in good condition. Table 2 lists predicted average per acre yields, based on seeded acres, for the principal crops grown on Garza County soils that are suited to cultivation. Yields are given for a high level of management for both dryland and irrigated soils.

A high level of management for dryland farming includes—

1. Conserving rainfall by using all necessary conservation measures. This includes a properly maintained terrace system, contour farming, and stubble mulch tillage.
2. Managing crop residue for effective erosion control.
3. Adequately maintaining soil tilth by:
   - (a) Using suitable cropping sequences to preserve an adequate supply of organic matter.
   - (b) Performing all tillage, harvesting, and grazing operations at optimum soil moisture to avoid soil compaction.
   - (c) Employing minimum but timely tillage consistent with weed control and seedbed preparation.
   - (d) Varying the depth of tillage.
4. Consistently using timely insect, disease, and weed control measures.
5. Improving crop varieties or strains selected.

A high level of management for irrigated farming includes—

1. Effective management of irrigation water by:
   (a) Timely application of water in amounts determined by soil and crop needs.
   (b) Uniform distribution and penetration of water.
   (c) Use of precautions to prevent furrow erosion.
2. Maintaining soil fertility by:
   (a) Timely application of fertilizer in amounts determined by soil and crop needs.
   (b) Efficient use of soil-improving crops.
3. Managing crop residue for effective erosion control.
4. Adequately maintaining soil tilth by:
   (a) Using suitable cropping sequences to preserve an adequate supply of organic matter.
   (b) Performing all tillage, harvesting, and grazing operations at optimum soil moisture to avoid soil compaction.
   (c) Practicing minimum but timely tillage consistent with weed control and seedbed preparation.
   (d) Varying depth of tillage.
5. Consistent use of timely insect, disease, and weed control measures.
6. Effective use of rainfall.
7. Improving crop varieties or strains selected.

The figures given in table 2 are based on information obtained from farmers, on observations and comparisons made by those familiar with the soils, and from research.

Management of the Soils for Rangeland

Prepared by HERSEL M. BELL, range conservationist, Soil Conservation Service.

There are approximately 450,000 acres in rangeland in Garza County. Beef cattle production is the primary livestock enterprise. Some ranchers produce horses for use in ranching operations. Ninety percent of the ranches and stock farms manage cowherds and sell feeder or replacement calves at weaning time. A few ranchers raise calves for market or to be sold as stocker cattle. There also are a few ranchers who operate feedlots and purchase yearling cattle to be run on the range until ready for market.

Most ranchers and all stock farms have some cropland, used for grazing and to produce feed, as a supplement to their grassland.

Range Sites and Condition Classes

Different kinds of soil differ in their capacity to produce grass and other plants for grazing. Soils that produce about the same kind and amount of forage when they are in a similar condition make up a range site. Rangelands differ in their ability to produce vegetation.

The soils that make up a given range site produce about the same kinds of plants. The climax vegetation for a site is the stabilized plant community; it reproduces itself and does not change so long as the environment remains unchanged. Throughout the rangeland, the climax vegetation consists of the same kinds of plants that were growing there when the region was first settled. If cultivated crops are not to be grown, the climax vegetation is generally the most productive combination of forage plants on a range site.

The management of a range site is determined by the response of the vegetation to grazing and other environmental influences.

Decreasers are plants in the climax vegetation that tend to decrease under close grazing. They generally are the most productive perennial grasses and forbs and those that are the most palatable to livestock.

Increasers are plants in the climax vegetation that increase as the more desirable plants are reduced by close grazing. They are ordinarily less productive and some are less palatable to livestock than the decreasers.

Invaders are plants that were not part of the climax vegetation, because they were unable to withstand the competition of plants in the climax vegetation for moisture, nutrients, and light. They will, however, establish themselves with the increasers after the climax vegetation has been reduced by grazing. Many invaders are annual weeds, and some are shrubs that have limited value for grazing.

Range condition is a measure of the condition of the existing vegetation in relation to that of the climax vegetation of a site. It is judged according to standards that apply to the particular range site. Four condition classes are used to indicate the degree of departure from the climax vegetation brought about by grazing and other influences: excellent, good, fair, and poor. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as in the original stand. It is in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture that the plants get during their growing season. Range production may vary directly with range condition, but not necessarily so. Yield of low-quality plants may equal or exceed that of the higher types of plants of the climax vegetation, but palatability and quality of forage will invariably be inferior on a range in poorer condition.

A primary objective of good range management is to keep rangeland in excellent to good condition. If this is done, water is conserved, yields are improved, and the soils are protected. This can be done only if important changes in the kind of cover on a range site are recognized. These changes take place gradually and can be misinterpreted or overlooked.

Growth encouraged by abundant rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the trend in both range condition and production is downward. On the other hand, some rangelands that have been closely grazed for relatively short periods under the supervision of a careful manager may have a degraded appearance that temporarily conceals their quality and ability to recover.

Descriptions of the Range Sites

In the following pages, the range sites in Garza County are discussed and the climax vegetation and principal invaders are named. If a site is in excellent condition, the total yield of herbage is given for favorable and unfavorable years.

Badland has not been described as a range site. There are over 6,000 acres in the county surveyed as Badland; in addition, about 1,500 acres are in the Vernon-Badland complex. Badland has little or no value for grazing. Randall clay is included in the range site adjacent to the lake area where it occurs. Drake soils are included with adjacent soils. They belong in the High Lime range site; because only 148 acres of these soils were mapped, however, the High Lime range site is not discussed.

Loamy Bottomland Site

This site is made up of nearly level, loamy soils on flood plains. These soils are subject to occasional overflow and to runoff from adjacent areas.

Where this range site is in good to excellent condition, it produces good stands of tall and mid grasses and there is only an occasional tree or shrub, such as hackberry or cottonwood. Improper grazing practices, particularly when the weather is adverse, cause the site to deteriorate rapidly. This deterioration is marked by loss of tall grasses invasion of numerous annual and perennial weeds, and encroachment of brush to the complete exclusion of grazable forage.

The climax vegetation consists of about 70 percent decreaser plants, including indiangrass, switchgrass, sand bluestem, little bluestem, side-oats grama, and Canada wildrye. Important climax increasers are vine-mesquite, western wheatgrass, blue grama, Texas bluegrass, Texas wintergrass, silver bluestem, and meadow dropseed. Where the site is saline, alkali sacaton is present and increases rapidly if the site deteriorates.

If climax vegetation is not maintained, the site is invaded by less productive forage plants, noxious weeds, and brush. Seeds washed in from cultivated fields and other areas contribute a wide variety of undesirable plants, including sunflower, cocklebur, wooly tidestromia, buffalo bur, hairy caltrop, camphorweed, annual broomweed, croton, thistle, sandbur, and western ragweed. Also, brush such as mesquite, condalia, and pricklypear generally limits forage production to that furnished by low-yielding grasses such as buffalograss, three-awn, and sand dropseed.

Because of overgrazing, this range site has generally deteriorated to a very low and unproductive condition. Except for those areas treated for brush control, the site is now infested with mesquite that ranges in size from low brush to sturdy trees. This site responds to brush control and to range seeding where flooding is not a problem or when establishment is possible between floods.

If this site is in excellent condition, the potential yield of air-dry herbage is 2,000 pounds per acre in less favorable years and as much as 3,400 pounds per acre in favorable years. These estimates are based on range clippings and on the experience of ranchers.

Sandy Bottomland Site

This site is made up of nearly level soils on flood plains. These soils are subject to frequent overflow.

Where this range site is in excellent condition, it is characterized by tall and mid grasses. Sand bluestem and switchgrass are the most important vegetation, but indiangrass, little bluestem, side-oats grama, and Canada wildrye are also included.

Climax increasers include western wheatgrass, vine-mesquite, meadow dropseed, silver bluestem, and hairy grama; alkali sacaton is present where this site is saline. Buffalograss, sand dropseed, three-awn, hooded windmillgrass, western ragweed, mesquite, sand sagebrush, lotebush, inland saltgrass, and saltcedar dominate the site as the range deteriorates.

The soils of this site respond to brush control treatment if there are desirable grasses left. Mechanical control of mesquite and saltcedar is more effective than spraying chemicals on the foliage. Basal application of oil and chemical formulations is effective on tree-type mesquite.

Range seeding on this site in conjunction with mechanical control of brush is effective; however, seedling establishment is often difficult unless the sandy soils are stabilized by plant residue or otherwise protected from soil blowing.

This is the most productive range site in the county. Where it is in excellent condition, annual air-dry yields of 2,200 pounds per acre may be expected in the less favorable years and up to 3,500 pounds per acre in favorable years.

Deep Hardland Site

This site is made up of nearly level to gently sloping, loamy soils. It is a shortgrass plain on which blue grama and buffalograss are the dominant forage plants. These and other short grasses, along with invading plants, continue to characterize the site even though it is deteriorating.

Climax decreasers include blue grama, side-oats grama, vine-mesquite, and western wheatgrass. Important increasers of the climax vegetation include buffalograss, silver bluestem, tobosagrass, white tridens, alkali sacaton, and Texas wintergrass.

As this site deteriorates, there is a change in the dominant grass, and buffalograss becomes more abundant than blue grama. With this change may be expected the invasion of low-quality grasses, annual and perennial weeds, and brush. Common invaders include perennial three-awn, sand dropseed, hairy tridens, Texas grama, tumblegrass, western ragweed, pricklypear, cholla, mesquite, and condalia.

Brush control is effective on this site. Good response of grass recovery may be expected from brush control if there still remains sufficient amounts of climax grasses to be managed. Management of climax grasses is an important part of the brush control treatment.

Because of the topography, this site is benefited by the use of water-spreading devices where there is a source of extra water. Such installations require engineering structures that are properly designed and installed.

When in excellent condition, this site produces annual air-dry yields of herbage ranging from 1,500 pounds per acre in unfavorable years to 2,300 pounds per acre in favorable years (fig. 24).

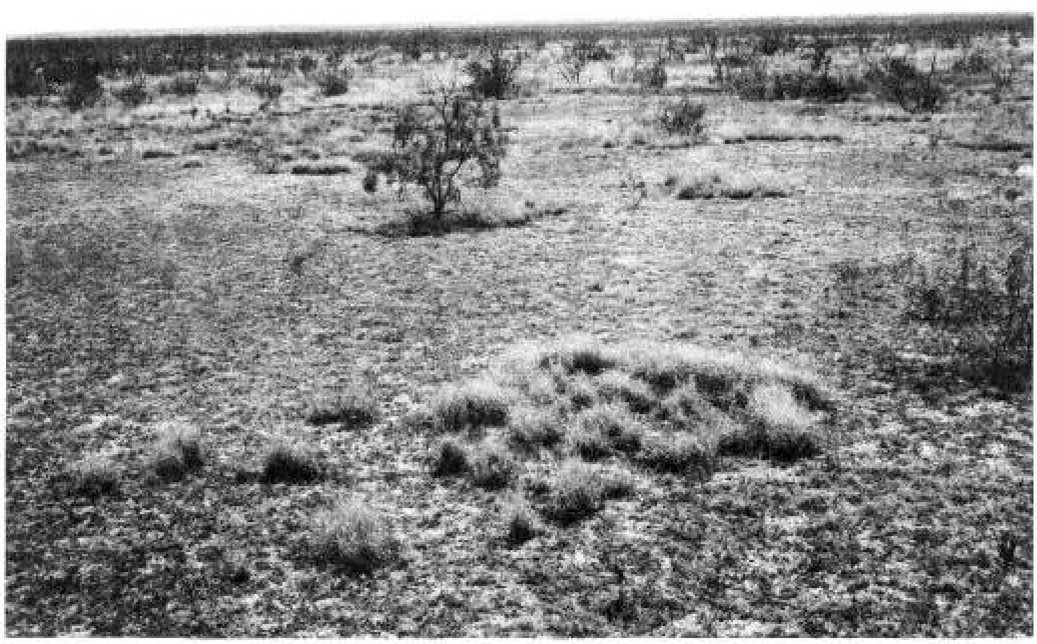


Figure 24.—Deep Hardland range site on Olton clay loam, 0 to 1 percent slopes.

Mixed Plains Site

This site is made up of nearly level to gently sloping loams. It differs from the Deep Hardland site in that side-oats grama is more abundant.

Climax decreasers include side-oats grama, blue grama, vine-mesquite, Arizona cottontop, plains bristlegrass, and needle-and-thread grass. Important increasers are buffalograss, hairy grama, and black grama. Common invaders on this site are perennial three-awn, sand dropseed, sand muhly, broom snakeweed, annuals, catclaw, and some mesquite.

As the site deteriorates, it first loses the side-oats grama, resulting in a general appearance similar to that of the Deep Hardland site where it is in better condition. This site responds to any suitable method of brush control, so good management is important. Range seeding also is effective and is most practical in conjunction with brush control, as are water control measures such as waterspreading.

Clippings and reports of experienced ranchers indicate air-dry herbage annual yields of about 1,300 pounds per acre in unfavorable years and about 2,000 pounds per acre in favorable years when this range site is in excellent condition.

Clay Flats Site

This site is made up of nearly level to gently sloping clay soils on alluvial fans.

Climax decreasers are side-oats grama, blue grama, western wheatgrass, vine-mesquite, and whitetridens. Climax increasers are tobosagrass, buffalo-grass, and alkali sacaton.

As this site deteriorates, tobosagrass becomes dominant and is responsible for the overall appearance of the range. It generally holds its own at the expense of practically all other grasses and allows no more than moderate invasion of woody plants. Those plants that do invade include pricklypear, cholla, condalia, and low-growing or running mesquite.

Because tobosagrass has very limited seasonal palatability, year-round grazing of this site results in a selective use of the better quality plants. This contributes to and hastens deterioration. This site responds to brush control when supported by good grazing management; however, it does not respond to range seeding.

If this site is in excellent condition, the potential yield of air-dry herbage is about 800 pounds per acre in less favorable years and as much as 2,000 pounds per acre in favorable years (fig. 25).

The estimates are based on range clippings and on the experience of ranchers.

Sandy Loam Site

This site is made up of nearly level to steep, fine sandy loams.

The climax vegetation of this site consists of short and mid grasses, the proportion of each varying according to the soil-moisture relationship. Climax decreasers make up approximately 70 percent of the vegetation; the important ones are blue grama, side-oats grama, little bluestem, Arizona cottontop, plains bristlegrass, vine-mesquite, sand lovegrass, and needle-and-thread grass. Important climax increasers are buffalograss, hairy grama, silver bluestem, perennial three-awn, and sand dropseed.

As this site deteriorates, it is invaded by tumble windmillgrass, gummy lovegrass, red lovegrass, hooded windmillgrass, red grama, western ragweed, spectacle pod, annual wild buckwheat, crotons, pricklypear, mesquite, yucca and other plants. This site responds to range seeding, brush control, water control measures, and other range management practices.

Where this site is in excellent condition, total annual air-dry yield ranges from about 1,600 pounds per acre in unfavorable years to about 2,550 pounds per acre in favorable years.

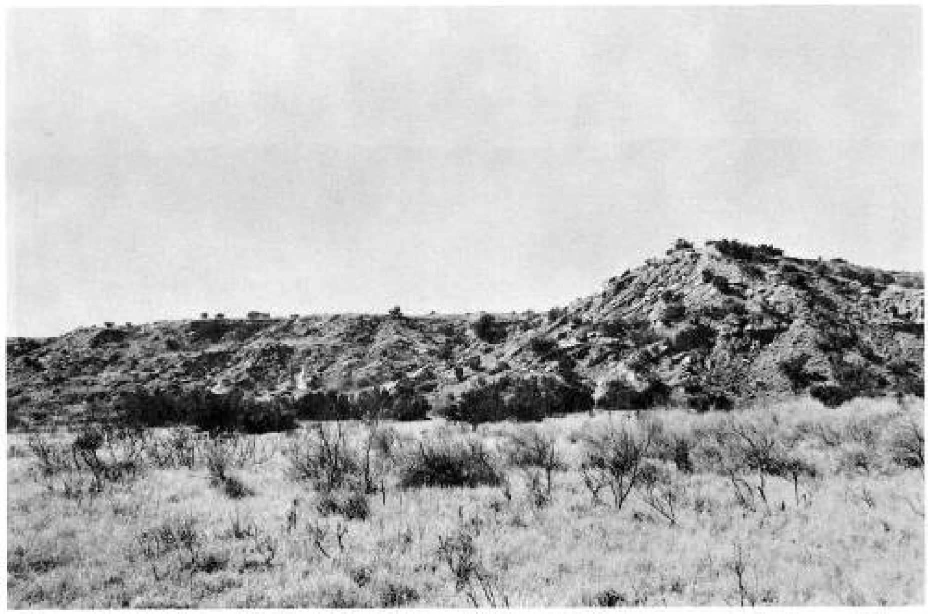


Figure 25.—Clay Flat range site on Dalby clay, 0 to 2 percent slopes; in background is area of Rough broken land.

Sandyland Site

This site is made up of nearly level to gently sloping soils in undulating and hummocky areas.

Climax decreasers make up approximately 70 percent of the vegetation and include indiangrass, sand bluestem, switchgrass, little bluestem, sand lovegrass, side-oats grama, and needle-and-thread grass, Important climax increasers are giant dropseed, sand dropseed, blue grama, hairy grama, silver bluestem, perennial three-awn, sand paspalum, fall witchgrass, hooded windmillgrass, sand sagebrush, and shin oak.

As the site deteriorates, it is invaded by gummy lovegrass, red lovegrass, tumble windmillgrass, tumble lovegrass, fringed signalgrass, western ragweed, queens-delight, yucca, and mesquite. This site generally responds quickly to brush and weed control by chemical methods. Mechanical methods are not feasible, because of the hazard of soil blowing. Grass recovery is ordinarily rapid after treatment for brush control, provided good range management is used. Where grass response is slow, overseeding may be successful. However, when seeding is necessary, the best known cultivation methods should be used for best results.

If the site is in excellent condition, the potential yield of air-dry herbage is about 1,300 pounds per acre in less favorable years and about 3,000 pounds per acre in favorable years (fig. 26). These estimates are based on range clippings and on the experience of ranchers.

Deep Sand Site

This site is made up of nearly level to steep and undulating, duned, sandy soils.

The climax vegetation is that of a tall-grass prairie that has scattered motts of scrub oak. Climax decreasers make up approximately 70 percent of the vegetation and include sand bluestem, indiangrass, switchgrass, little bluestem, sand lovegrass, big sand reedgrass, and needle-and-thread grass. Climax increasers are side-oats grama, giant dropseed, silver bluestem, hooded windmillgrass, hairy grama, sand paspalum, sand dropseed, perennial three-awn, fall witchgrass, and shin oak.

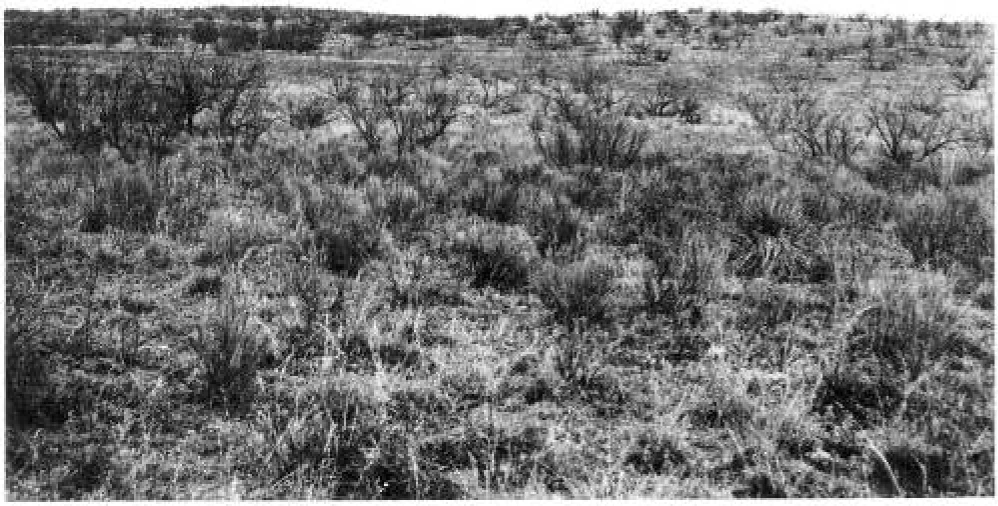


Figure 26.—Sandyland range site, showing typical rolling topography and scattered mesquite trees. The soil is Miles loamy fine sand, 0 to 3 percent slopes.

As this site deteriorates, it is invaded by gummy lovegrass, tumblegrass, tumble lovegrass, red lovegrass, tumble windmillgrass, fringed signal-grass, yucca, sand sagebrush, groundsels, Queensdelight, western ragweed, and annuals. This site responds to brush control by spraying chemicals on the foliage. Generally the response is evidenced by greatly improved stands of better grasses that are climax to the site. Where satisfactory grass response does not follow, range seeding for brush control may be successful.

If this site is in excellent condition, the potential yield of air-dry herbage is about 1,400 pounds per acre in less favorable years and about 3,500 pounds per acre in favorable years. These estimates are based on forage clippings and on the experience of ranchers.

Shallow Redland Site

This site is made up of gently sloping to steep and hilly soils on ridges and foot slopes.

Where this site is in climax condition, the total basal ground cover is not more than 20 percent. Of this coverage, decreaser grasses make up 65 to 70 percent of the vegetation and include blue grama, side-oats grama, vine-mesquite, little bluestem, and sand bluestem. Increasers are buffalograss, tobosagrass, hairy grama, sand dropseed, perennial three-awn, silver bluestem, and slim and rough tridens.

As this site deteriorates, the better grasses concede to such invading plants as hairy tridens, sand muhly, Texas grama, red grama, mesquite, pricklypear, redberry juniper, and numerous annual and perennial weeds. The smoother areas of deeper soils respond to brush control. The rougher areas of shallow soils do not respond to brush control.

If the site is in excellent condition, the potential yield of air-dry herbage is about 900 pounds in less favorable years and about 1,600 pounds per acre in favorable years (fig. 27). These estimates are based on range clippings and on the experience of ranchers.

Figure 27.—Typical topography and vegetation of Shallow Redland range site on Vernon soils, 3 to 5 percent slopes.

Very Shallow Site

This site is made up of nearly level to gently sloping, shallow to very shallow soils. These soils in many places have exposed caliche rock, caliche gravel, and sandstone. The vegetation is generally sparse.

When in climax condition, the vegetation of this site has a mid-grass aspect. There are, however, grasses of both short-grass and tall-grass climax vegetation because of the variability of the soils. The important decreasers are side-oats grama, blue grama, Arizona cottontop, plains bristlegrass, vine-mesquite, little bluestem, and sand bluestem. Increasers that are significant are hairy grama, black grama, buffalograss, silver bluestem, perennial three-awn, and slim and rough tridens.

As this site deteriorates, it is invaded by hairy tridens, Texas grama, sand dropseed, pricklypear, mesquite, yucca, and redberry juniper.

Because of the physical nature of this site, there is little treatment other than range management that is applicable. The control of brush species that have invaded may be feasible; however, their removal may contribute to the hazard of erosion on the site.

If this site is in excellent condition, the potential yield of air-dry herbage is about 400 pounds per acre in less favorable years and about 1,000 pounds per acre in favorable years. These estimates are based on the experience of ranchers.

Rough Breaks Site

This site is made up of rough escarpments and other areas having rough topography. The vegetation is sparse, and 75 percent of the site is bare.

Decreasers include indiangrass, Canada wildrye, sand bluestem, little bluestem, side-oats grama, blue grama, plains bristlegrass, Arizona cottontop, and vine-mesquite. Increasers are hairy grama, silver bluestem, slim tridens, fall witchgrass, sand dropseed, perennial three-awn, and buffalograss. Some annuals invade the site, but invaders are mostly shrubs or woody plants, including catclaw, condalia, pricklypear, yucca, mesquite, and redberry juniper. Because of the rough terrain, there is little that can be done to treat this site, Range improvement practices are not feasible and have little application on this site.

Potential yield of air-dry herb age is 500 pounds per acre in less favorable years and 900 pounds per acre in favorable years. These estimates are based on range clipping.

Management of the Soils for Wildlife

The soils of Garza County are grouped in 4 wildlife sites. These groupings are by soil associations, which are described in the section “General Soil Map”. Each site is different in topography, productivity, vegetation, species of wildlife, and treatment needed to maintain or improve a desired wildlife habitat.

Wildlife Site 1

This site consists mainly of the Olton-Acuff, Olton-Vernon, and Miles soil associations, which make up most of the cultivated soils in the county.

The Olton-Acuff soil association is predominantly cultivated, whereas only parts of the Olton-Vernon and Miles soil associations are cultivated. Native vegetation consists of short and mid grasses, together with an overstory of mesquite trees.

Crops grown in the cultivated areas supply seasonal food for quail, dove, song birds, and rabbit. Food is in good supply during certain periods. Water is available in most areas except in some of the large cultivated areas. Sufficient cover for wildlife is not always available on this site, especially in the large blocks of cultivated fields. Weeds and brush growing in fence rows along cropland provide some food and cover for rabbit, quail, and song birds.

The principal wildlife species are rabbit, coyote, bobcat, antelope, scaled quail, dove, and song birds.

Wildlife Site 2

This site consists of the Brownfield-Miles soil association. Only a small part of this site is cultivated, and many areas that were formerly cultivated have returned to grass or are idle. Native vegetation is mostly tall and mid grasses and an overstory of shin oak and scattered mesquite trees.

This site provides good food and cover for wildlife, and old fence rows around formerly cultivated fields also provide good food and cover for quail, rabbit, and song birds. Crops grown in cultivated fields provide food for wildlife for a part of the year. Water in this site is in short supply because the soils and topography are not suitable for ponds and because windmill water is not available in all locations.

The principal wildlife species are rabbit, bobcat, coyote, bobwhite quail, dove, and song birds.

Wildlife Site 3

This site consists of the Mobeetie-Berda-Rough broken land and the Vernon-Rough broken land soil associations. This is mainly an area of rough, steep, and broken land below the High Plains escarpment and along the rivers and streams that dissect the county. It also includes the gently sloping to steep, gullied areas where soils have developed in clayey and shaly red beds. Native vegetation consists of a sparse stand of short, mid, and tall grasses and an overstory of juniper and mesquite.

Food is limited on this site, but the juniper provides adequate cover for most species of wildlife. Most areas in this site make good pond sites, and adequate water is available.

Principal wildlife species are rabbit, bobcat, coyote, deer, raccoon, scaled quail, bobwhite quail, dove, turkey, and song birds.

Wildlife Site 4

This site is made up of the Dalby association. It consists of areas of broad, local, nearly level to gently sloping dense clays on alluvial flats. Vegetation is mostly tobosa grass and scattered scrub mesquite.

This site is suitable for pit-type ponds, and adequate water is usually available. This site is poorly suited to most species of wildlife because of the limited amount of food that is produced and because the cover is inadequate.

The principal wildlife species are rabbit, coyote, scaled quail, and song birds.

Engineering Uses of the Soils

By Y. E. McADAMS, area engineer, Soil Conservation Service, Lubbock, Texas.

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, facilities for water storage, erosion control structures, drainage systems, irrigation systems, and sewage disposal systems. Among the properties most important to the engineer are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and reaction. Depth to water table, depth to bedrock, topography, and hydrologic characteristics are important also.

The interpretations given in this section will be helpful to readers who are interested in the general characteristics of the soils. Engineers and those in related work will be interested in the tabular data. The information in this survey can be used by engineers to—

1. Make preliminary estimates of the engineering properties of soils in the planning of terraces, farm ponds, irrigation systems, and other structures for the conservation of soil and water.
2. Make preliminary evaluations of soil and ground conditions that will aid in the selection of locations for highways, airports, and pipelines and in planning detailed investigations of soils at the selected sites.
3. Locating probable sources of topsoil for top-dressing or road subgrade suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.
5. Determine the suitability of soils for the cross-country movement of vehicles and construction equipment.
6. Obtain supplemental information from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
7. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Tables 3, 4, and 5 provide data useful in soils engineering. With the use of the soil map for identification, these interpretations can be useful for many purposes. It should be emphasized that the engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. The estimated values for traffic-supporting capacity expressed in words should not be assigned specific values. Estimates are generally made to a depth of about 5 feet, and interpretations do not apply to greater depths.

There are small areas of other soils included in the mapping units that may have different engineering properties than those listed. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some terms used by soil scientists may be unfamiliar to engineers, and some words have different meanings in soil science than they have in engineering. Among the terms that have special meaning in soil science are gravel, sand, silt, and clay. These and other terms are defined in the Glossary at the back of this survey.

Engineering Classification Systems

Agricultural scientists of the U.S. Department of Agriculture (USDA) classify soils according to texture, color, and structure. This system is useful only as the initial step in making engineering classifications of soils. The engineering properties of a soil must be determined or estimated after the initial classifications have been made. Two systems are used by engineers for classifying soils. These are the systems used by the American Association of State Highway Officials (AASHO) and the Unified system. These systems are explained briefly in the paragraphs that follow.

AASHO Classification System.—Most highway engineers classify soil material according to the system approved by the American Association of State Highway Officials (AASHO) (1). In this system soil material is classified in seven principal groups. The groups range from A-1, which consists of gravelly soils of high bearing capacity, to A-7, which consists of clay soils having low strength when wet. Within each group, the relative load-carrying capacity of the soil material is indicated by a group index number. These numbers range from 0 for the best material to 20 for the poorest. The group index numbers are determined by the gradation, liquid limit, and plasticity index.

Unified Classification System.—Some engineers prefer to use the Unified Soil Classification System. In this system soil material is divided into 15 classes. Eight classes are for coarse-grained material (GW, GP, GM, GC, SW, SP, SM, and SC): six are for fine-grained material (ML, CL, OL, MH, CH, and OH); and one (Pt) is for highly organic material. Mechanical analyses are used to determine the GW, GP, SW, and SP classes of material; mechanical analyses and tests for liquid limit and plasticity index are used to determine the GM, GC, SM, and SC classes and all of the classes of fine-grained soils. The soils of this county have been classified in the GM, GC, SP, SM, SC, ML, CL, and CH classes.

Engineering Properties

Table 3 gives the estimated engineering classification and some of the estimated physical properties of the soils in Garza County. Some of the estimates were made on the basis of tests of 4 samples from 2 soil series. The results of these tests are shown in table 5. For the soils not listed in table 5, properties were estimated by comparing the soils with the soils of similar series in the survey area, and in other survey areas and from field tests.

In the column headed “Depth to bedrock,” the depth is given in inches from the surface to consolidated materials.

In the column headed “Percentage passing sieve,” estimates are given for the percentage of soil materials passing sieves of four different sizes. This information is useful in helping to determine the suitability of the soil as a source of material for construction purposes.

Permeability, as shown in table 3, is the estimated rate in inches per hour that water moves through the soil. The estimates are for each soil as it occurs in place without compaction.

The available water capacity is given in inches of water per inch of soil and is the capacity of soils to hold water available for use by most plants. It is defined as the difference between the amount of soil water at field capacity and the amount at wilting point.

In column headed “Reaction,” the degree of acidity or alkalinity is expressed in pH values. The pH of a neutral soil is 7.0, of an acid soil it is less than 7.0, and of an alkaline soil it is more than 7.0. For a description of the pH groups used in table 3, see “Reaction, soil,” in the Glossary at the back of this survey.

The shrink-swell potential indicates the change in volume that occurs in a soil with changes in moisture content; that is, the extent to which soil shrinks when dry and swells when wet. This potential change is influenced by the amount and kind of clay in the soil. Single-grain soils and soils that contain small amounts of plastic materials have a low shrink-swell potential. A knowledge of this potential is important in planning the use of a soil for building roads and other engineering structures. Shrink-swell potential is rated *low*, *moderate*, and *high*.

In the column headed “Hydrologic group,” the soils are placed in one of four groups on the basis of intake of water at the end of long-duration storms occurring after prior wetting and opportunity for swelling and without the protective effects of vegetation. The groups range from open sands (lowest runoff potential, Group A) to heavy clays (highest runoff potential, Group D). Descriptions of these four groups are as follows:

Group A.—Soils having a high infiltration rate even when thoroughly wetted. These soils consist chiefly of moderately deep, well-drained to excessively drained sands and gravel. They have a high rate of water transmission, which results in a low runoff potential.

Group B.—Soils having a moderate infiltration rate when thoroughly wetted. These soils consist chiefly of moderately deep to deep, moderately well drained to well drained soils that have a moderately fine to moderately coarse texture. They have a moderate rate of water transmission.

Group C.—Soils having a slow infiltration rate when thoroughly wetted. These are chiefly (1) soils that have a layer that impedes the downward movement of water or (2) soils that have a moderately fine to fine texture and a slow infiltration rate. These soils have a slow rate of water transmission.

Group D.—Soils having a very slow infiltration rate when thoroughly wetted. These are chiefly (1) clay soils that have a high swelling potential, (2) soils that have a high permanent water table, (3) soils that have a claypan or clay layer at or near the surface, and (4) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Engineering Interpretations

In table 4 the soils are rated according to their suitability as sources of topsoil and as sources of road subgrade. Also listed for the soils are properties that affect the suitability of the soils as sites for specific engineering works. The estimates in table 4 were made on the basis of the test data in table 5, the properties listed in table 3, and observations of the field performance of the soils.

A seasonal high water table is not a problem in Garza County. The water table is many feet below the surface.

As indicated in table 4, the soils in the county are rated as a source of topsoil. Topsoil is fertile soil material that ordinarily is rich in organic matter. It is used to topdress areas where vegetation is to be established and maintained. Such areas are roadbanks, dams, disturbed areas, gardens, and lawns. Normally, only the surface layer is removed for topsoil, but other layers also may be suitable sources.

The soils in the county are rated as a source of road fill. Road fill refers to soil material useful for building up road grades for supporting base layers. The suitability of a soil for road fill depends on its texture, plasticity, shrink-swell potential, traffic-supporting capacity, inherent erodibility, compaction characteristics, and natural water content. Soils that have moderate shrink-swell potential are difficult to place and compact.

The factors considered for highway location are those features and qualities of the soil that affect the overall performance of the soil for the location of highways. The entire soil profile is evaluated, and this evaluation is based on an undisturbed soil without artificial drainage. It is assumed that the surface soil, because of its higher organic matter content, will be removed in construction and used for topsoil.

The factors considered for foundations for low buildings are those features and qualities of undisturbed soils that affect their suitability for supporting foundations of low buildings less than three stories high. The foundation of a building transmits the weight of the structure onto the natural, undisturbed soil. It is the substratum of the soil that generally provides the base for foundations and therefore is the material that should be evaluated. The Unified Classification System was used for evaluating the soils in terms of their shrink-swell potential and shear strength.

Soil features that determine the limitations for septic tank filter fields and sewage lagoons are permeability, ground water level, hazard of flooding, slope, depth to rock or other impervious materials, and creviced material that may cause pollution of water supplies.

The suitability of soils for reservoir areas depends primarily upon the seepage rate. Highly plastic soils have low seepage, and coarse-textured soils do not have any binding or sealing characteristics but have a high seepage rate.

The factors considered for farm pond embankments are those features and qualities of disturbed soils that affect their suitability for constructing embankments. The primary features that affect suitability are stability, compaction characteristics, susceptibility to piping, shrink-swell potential, compacted permeability, compressibility, erodibility, and gypsum content.

Suitability of the soils for irrigation depends largely on intake rate, available water capacity, depth, slope, and hazard of flooding.

Terraces and diversions constructed from coarse-textured soils are difficult to maintain. Soil blowing and water erosion are serious hazards in maintaining terrace ridges and channels at desired specifications.

Waterways on the soils of Garza County have to be carefully stabilized. On the highly erodible soils, the accumulation of wind-blown material in waterways creates a difficult maintenance problem.

Steel pipe should have a protective coating if it is placed in any soil in the county to retard corrosion. Corrosivity ratings are given for the soils of the county for steel (based on soil conditions at a depth of 4 feet) and concrete in table 4.

Engineering Test Data

Engineering test data for four samples of soils of the Dalby and Vernon series in Garza County are given in table 5. These data were furnished by the Texas Highway Department. Some of the terms used in table 5 are discussed in the paragraphs that follow.

As moisture is removed, the volume of a soil decreases in direct proportion to the loss of moisture until a condition of equilibrium, called the shrinkage limit, is reached. Beyond the shrinkage limit, more moisture may be removed but the volume of the soil does not change. Generally, the lower the number for shrinkage limit, the higher the content of clay.

Shrinkage ratio is the volume change that results from the drying of a soil material divided by the loss of moisture caused by drying. The ratio is expressed numerically.

Lineal shrinkage is the decrease in one dimension of the soil when the moisture content is reduced from a given percentage to the shrinkage limit (3). Lineal shrinkage is expressed as a percentage of the original dimension.

The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. Liquid limit is the moisture content at which a soil passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil is in a plastic condition.

FORMATION AND CLASSIFICATION OF THE SOILS

This section explains how soils form and the factors that are involved in their formation. It describes briefly the system of soil classification and shows how the soils of Garza County are classified. Technical terms used in this section are defined in the Glossary at the back of this survey.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent materials; (2) the climate under which the soil material has accumulated; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. It may be much or little, but some time is always required for horizon differentiation. Usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent Material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineralogical composition of the soil.

The soils in the High Plains part of Garza County were formed in Rocky Mountain outwash of the Tertiary period and were partially reworked by wind during the Quaternary period. This material consists mainly of alkaline to calcareous, unconsolidated, sandy and silty material. Wind sorting has removed most of the silt and clay from the parent material of some of the sandy soils.

The soils of the Rolling Plains formed from four different kinds of parent material: (1) alluvial outwash, (2) material from clayey red beds and sandstones of Triassic age, (3) recent deposits of alluvium, and (4) wind-deposited sands. Most of the soils of the Rolling Plains formed from alluvial outwash similar to the parent material of the soils of the High Plains.

Large areas of moderately fine textured and fine textured soils formed from material derived from the exposed red-bed clays and shales.

The parent material of soils on the flood plains of streams and in drainageways consists of recent deposits of alluvium.

Climate

Garza County has a warm, temperate, subtropical climate characterized by dry winters and long summers. The wide variation in temperature has favored the weathering of parent materials to form soil.

Wind has had and is still having an effect on the formation of soils in the county. It aids in the breakdown of parent materials, in reworking many deposits, and in shifting materials from place to place. Because of high winds, evaporation is high and water rarely moves below the normal rooting zone.

Calcium carbonate has been leached from the upper horizons of most of the soils in the county and has accumulated in layers in many of the soils. As the carbonates were leaching, clay particles were also moved down, where they accumulated to form a slowly permeable horizon.

Living Organisms

Vegetation, micro-organisms, earthworms, and other forms of life that live on and in the soils contribute to their development. The type and amount of vegetation are important. They are determined partly by the climate and partly by the kind of parent material. Climate limited the vegetation of Garza County mainly to grass. The parent material determined whether the grass would be tall, as on the sands, or short, as on the clays.

The mixed prairie type of vegetation contributed large amounts of organic matter to the soils. This organic matter was derived largely from decaying leaves, stems, and roots. The decay of this organic matter was brought about by micro-organisms and bacteria.

Many other forms of life began working and churning the soil after it had been enriched with organic matter. Earthworms are the most noticeable form of animal life in the soil. Worm casts facilitate the movement of air, water, and plant roots in the soil.

Soil-dwelling rodents have had a part in the development of some soils. Large prairie dog towns once thrived in various parts of the county. The burrowing of these animals brought limy material to the surface and thus did much to offset the leaching of free lime from the soil. Some soil structure, however, was destroyed at the same time.

The influence of man on the soil-forming processes cannot be ignored. Man first fenced the range and overgrazed it, which changed the vegetation. Then, by tilling the soil, harvesting crops, and allowing runoff and soil blowing, he reduced the amount of organic matter and silt and clay particles in the plow layer. By the use of heavy machinery and by poorly timed tillage, he has compacted the soil and restricted the movement of water, air, and plant roots. Man has also drastically changed the moisture regime in some areas by irrigating. The effects of the changes made by man are evident in the soils of the county, and they will affect the rate of development in the future.

Relief

The position in which a soil develops on the landscape influences the characteristics of that soil. Relief has influenced soil development in Garza County through its effect on drainage and runoff. The soils that have developed in low, concave areas in this county are deep and generally more clayey than the soils that have developed in more sloping areas. This is because the soils in low, concave areas receive extra water, have less runoff, and are subject to less erosion. In addition, these soils produce more plant residue and support more biological activity.

Many of the soils in Garza County have developed in gently sloping to sloping areas. As the slope becomes steeper, the soils are less developed. The soils that have steeper slopes are shallower, because geologic erosion occurs as fast as the soils develop.

Time

The characteristics of a soil are strongly affected by the length of time that the soil-forming processes have acted upon the soil. Parent materials that have been in place for only a short time have not yet been influenced enough by climate and living organisms to develop well-defined and genetically related soil horizons.

On steeper slopes, soils have an immature profile because geologic erosion has removed the products of soil formation as fast as the soils developed. Soils that have been in place for a long time have approached equilibrium with their environment in soil development, and they have a mature, well-developed profile. These soils show horizon differentiation. They are generally well-drained soils that occupy the gently sloping areas of the county.

Classification of Soils

Soils are classified so that we may more easily remember their significant characteristics, assemble knowledge about them, see their relationships to one another and to the whole environment, and develop principles that help us understand their behavior and response to manipulation.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (2) and later revised (5). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study. Therefore, readers interested in developments of the system should search the latest literature available (4, 7).

The current system of classification defines classes in terms of observable or measurable properties of soils. The properties chosen are those that permit grouping soils that are similar in genesis. Genesis, or mode of soil origin, does not appear in the definitions of the classes; it lies behind the classes. The classification is designed to accommodate all soils. It employs a unique nomenclature that is both connotative and distinctive.

The classification has six categories. Beginning with the most inclusive, the categories are the order, suborder, great group, subgroup, family, and series.

The classification of the soil series in Garza County is shown in table 6. They are classified according to family, subgroup, and order.

Climate

By ROBERT E. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce

Garza County has a warm, temperate, subtropical climate characterized by dry winters and long summers. The county lies in the semi-arid, transitional zone between the desert like region of eastern New Mexico and the more humid region of Central and East Texas. Average annual precipitation is 18.82 inches.

Rainfall occurs most frequently as the result of thunderstorms; monthly and annual amounts are extremely variable. During the wettest year on record, 1941, total precipitation was more than eight times the total during the driest year, 1956, when only 4.99 inches fell. Maximum precipitation usually occurs during May and June, when warm, moist tropical air is carried far inland from the Gulf of Mexico. This air mass produces moderate to heavy afternoon and evening convective thunderstorms, sometimes accompanied by hail. Approximately three-fourths of the average precipitation at Post, Texas, falls during the warm season, May through October (table 7).

Periods of drought, or rainfall deficiency, occur frequently. Periods when no rain falls for 2 to 3 weeks are common, and monthly periods of no measurable rain have been observed in all months of the year. Total precipitation for the month of June has ranged from none in both 1925 and 1945 to as much as 11.35 inches in 1963. In one year out of every 10, on an average, total rainfall is less than 12 inches. Also, in 1 year out of every 10, total rainfall is more than 26 inches. During exceptionally wet years, little benefit is derived from much of the precipitation because it results from heavy thundershowers that produce excessive runoff and erosion.

The Gulf of Mexico source region is rather effectively cut off during the colder months by frequent surges of drier polar air masses that invade the area from the north. Consequently, precipitation is relatively light in winter. The average monthly precipitation drops sharply from October to November, and it is less than three-quarters of an inch from December through March.

Snow falls occasionally during the winter months but generally is light and ineffective as a source of moisture. The mean monthly snowfall amounts are unduly influenced by rare but exceptionally heavy snows, such as occurred in February 1938 and again in December 1942. Actually, measurable snow is .likely to fall in December in only 1 year in 3, on an average.

Temperature, like rainfall, is extremely variable, especially during the colder 6 months of the year. From November through March, cold fronts are frequent and bring rapid and pronounced changes. However, cold spells are of short duration, rarely lasting more than 48 hours before west and southwest winds bring warmer temperatures. The largest temperature fluctuations occur in spring, when strong fast-moving cold fronts may bring an abrupt end to short periods of unseasonably warm weather. The average daily minimum temperature in January is approximately 27° F. Summers are hot, and the average daily maximum temperature is approximately 95° in July.

The mean last day in spring when the temperature is 32° or lower is April 5, and November 7 is the mean first day when the temperature is 32° or lower. The average length of the growing season is 216 days. The average annual relative humidity is 75 to 80 percent at 6 a.m., 45 to 50 percent at noon, 40 to 45 percent at 6 p.m., and 60 to 65 percent at midnight.

The average annual amount of possible sunshine is 70 to 75 percent. Average annual class A pan evaporation is 100 to 105 inches. The average annual lake evaporation is 70 to 72 inches.

Severe wind or hailstorms may accompany heavy thunderstorm activity, especially late in spring and early in summer. Damage to crops in the county may result from either the wind, the hail, or the excessive rainfall that accompanies these storms. Fortunately, the frequency of occurrence of severe storms for any specified locality is relatively low. The strongest and most locally damaging winds that occur in the area are these gusts and squalls that subside as soon as the thunderstorms have passed. The strongest continuous winds occur during February, March, and April. These are associated with intense low pressure centers that move across the area from west to east. The wind may be very strong for a day or more, producing dust storms and erosion.

The “Caprock,” or edge of the Llano Estacado, that lies across the western part of Garza County has a pronounced influence on the weather when the wind is from the east, especially in winter. The air is cooled slightly as it moves upslope over the “Caprock,” which increases the amount of low cloudiness and drizzle in cold air masses when the wind has an easterly component.

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GLOSSARY

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bedding plane. Horizontal contact plane or face between strata that were mainly deposited by water.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gypsite. An incoherent mass of small gypsum crystals having a soft, earthy appearance and containing impurities such as silica or clay.

Horizon, soil. A layer of soil, approximately parallel to the surface that has distinct characteristics produced by soil-forming processes. These are the major horizons:

0 horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an 0 horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Packsand. A massive, coherent layer or bed of geologic sand that is or has been under pressure.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

Permian red-bed. Geologic material of Permian age consisting of weakly cemented sandstones and shales having a reddish color.

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. Structureless soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, non-aggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying lying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Soil	Area	Extent	Soil	Area	Extent
	Acres	Percent		Acres	Percent
Abilene clay loam, 0 to 1 percent slopes	7,128	1.2	Mobeetie fine sandy loam, 3 to 5 percent slopes	17,859	3.1
Acuff loam, 0 to 1 percent slopes	8,926	1.5	Mobeetie-Latom fine sandy loams, 2 to 20 percent slopes	10,895	1.9
Acuff loam, 1 to 3 percent slopes	2,901	.5	Mobeetie-Potter association, rolling	17,550	3.0
Amarillo fine sandy loam, 0 to 1 percent slopes	562	.1	Nobscot fine sand, 0 to 5 percent slopes	5,346	.9
Amarillo fine sandy loam, 1 to 3 percent slopes	750	.1	Olton clay loam, 0 to 1 percent slopes	9,176	1.6
Badland	6,061	1.0	Olton clay loam, 1 to 3 percent slopes	36,470	6.2
Berda loam, 1 to 3 percent slopes	12,127	2.1	Olton loam, 0 to 1 percent slopes	55,921	9.6
Berda loam, 3 to 5 percent slopes	14,271	2.4	Olton loam, 1 to 3 percent slopes	3,939	.7
Bippus loam, 1 to 3 percent slopes	3,279	.6	Portales loam, 0 to 1 percent slopes	2,618	.5
Brownfield fine sand, 1 to 5 percent slopes	34,721	5.9	Portales loam, 1 to 3 percent slopes	743	.1
Clairemont silt loam	2,164	.4	Potter soils, 0 to 5 percent slopes	3,930	.7
Dalby clay, 0 to 2 percent slopes	40,290	6.9	Randall clay	3,723	.6
Drake soils, 2 to 5 percent slopes	148	(1/)	Rough broken land	51,905	8.9
Lincoln soils	5,369	.9	Spade and Veal fine sandy loams, 1 to 3 percent slopes	2,519	.4
Lincoln-Yahola complex	14,297	2.5	Spade and Veal fine sandy loams, 3 to 5 percent slopes	6,614	1.1
Lubbock clay loam, 0 to 1 percent slopes	1,507	.3	Spur clay loam	5,164	.9
Mansker loam, 0 to 1 percent slopes	259	(1/)	Spur fine sandy loam	2,532	.4
Mansker loam, 1 to 3 percent slopes	3,728	.6	Tivoli fine sand	2,242	.4
Mansker loam, 3 to 5 percent slopes	796	.1	Tivoli-Brownfield soils, rolling	642	.1
Miles fine sandy loam, 0 to 1 percent slopes	6,968	1.2	Vernon-Badland complex, hilly	4,654	.8
Miles fine sandy loam, 1 to 3 percent slopes	36,074	6.2	Vernon complex, hilly	36,910	6.3
Miles fine sandy loam, 3 to 5 percent slopes	11,882	2.0	Vernon soils, 1 to 3 percent slopes	19,275	3.3
Miles loamy fine sand, 0 to 3 percent slopes	18,171	3.1	Vernon soils, 3 to 5 percent slopes	34,611	5.9
Miles-Springer loamy fine sands, 3 to 5 percent slopes	3,676	.6	Zita loam, 0 to 1 percent slopes	282	.1
Mobeetie fine sandy loam, 1 to 3 percent slopes	4,284	.7	River and creek channels; pits	9,037	1.5
			Water area	704	.1
			Total	585,600	100.0

1/ Less than 0.1 percent

TABLE 2.--PREDICTED AVERAGE ACRE YIELDS OF PRINCIPAL CROPS ON DRYLAND SOILS AND IRRIGATED SOILS UNDER A HIGH LEVEL OF MANAGEMENT

[Only the arable soils are listed in this table. Absence of data indicates that the crop generally is not grown on the soil named]

Soil	Dryland soils		Irrigated soils	
	Cotton	Grain sorghum	Cotton	Grain sorghum
	Lb.	Lb.	Lb.	Lb.
Abilene clay loam, 0 to 1 percent slopes	225	1,300	---	-----
Acuff loam, 0 to 1 percent slopes	225	1,300	900	7,000
Acuff loam, 1 to 3 percent slopes	200	1,200	800	6,000
Amarillo fine sandy loam, 0 to 1 percent slopes	225	1,250	900	7,000
Amarillo fine sandy loam, 1 to 3 percent slopes	190	1,250	800	6,000
Berda loam, 1 to 3 percent slopes	175	1,000	---	-----
Berda loam, 3 to 5 percent slopes	---	900	---	-----
Bippus loam, 1 to 3 percent slopes	175	1,250	---	-----
Clairemont silt loam	225	1,300	---	-----
Dalby clay, 0 to 2 percent slopes	150	1,000	---	-----
Drake soils, 2 to 5 percent slopes	---	900	---	-----
Lubbock clay loam, 0 to 1 percent slopes	190	1,200	850	7,000
Mansker loam, 0 to 1 percent slopes	180	975	600	4,000
Mansker loam, 1 to 3 percent slopes	170	950	550	3,500
Mansker loam, 3 to 5 percent slopes	---	900	---	-----
Miles fine sandy loam, 0 to 1 percent slopes	225	1,250	---	-----
Miles fine sandy loam, 1 to 3 percent slopes	200	1,250	---	-----
Miles fine sandy loam, 3 to 5 percent slopes	170	1,000	---	-----
Miles loamy fine sand, 0 to 3 percent slopes	170	1,000	---	-----
Mobeetie fine sandy loam, 1 to 3 percent slopes	180	1,000	---	-----
Mobeetie fine sandy loam, 3 to 5 percent slopes	---	975	---	-----
Olton clay loam, 0 to 1 percent slopes	225	1,300	---	-----
Olton clay loam, 1 to 3 percent slopes	175	1,250	---	-----
Olton loam, 0 to 1 percent slopes	225	1,300	925	7,500
Olton loam, 1 to 3 percent slopes	200	1,275	800	6,000
Portales loam, 0 to 1 percent slopes	200	1,275	850	6,000
Portales loam, 1 to 3 percent slopes	190	1,200	750	5,000
Spade and Veal fine sandy loams, 1 to 3 percent slopes	170	1,000	---	-----
Spade and Veal fine sandy loams, 3 to 5 percent slopes	---	900	---	-----
Spur clay loam	375	1,300	---	-----
Spur fine sandy loam	350	1,250	---	-----
Vernon soils, 1 to 3 percent slopes	---	900	---	-----
Zita loam, 0 to 1 percent slopes	300	1,200	900	7,000

TABLE 3.--ESTIMATED ENGINEERING PROPERTIES

[Properties of Badland (Ba) and Rough broken land (Ro) are too variable to be estimated. An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series. The symbol < means less than; the symbol means less than; the symbol > means more than]

Soil series and map symbols	Depth to bedrock	Depth from surface	Classification: USDA texture	Classification: Unified	Classification: AASHO	Percentage passing sieve-- No. 4 (4.7 mm.)	Percentage passing sieve-- No. 10 (2.0 mm.)	Percentage passing sieve--Continued No. 40 (0.42 mm.)	Percentage passing sieve--Continued No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic group
	Inches	Inches								Inches per hour	Inches per inch of soil	pH		
Abilene: AbA	60+	0-13	Clay loam	CL	A-6	100	100	95-99	75-80	0.63-2.0	0.17-0.20	7.4-7.8	Moderate.	C
		13-44	Clay	CL	A-6	100	100	95-99	75-85	0.20-0.63	0.16-0.20	7.9-8.4	Moderate.	
		44-74	Clay loam	CL	A-6	100	100	90-98	70-80	0.63-2.0	0.17-0.15	7.9-8.4	Low.	
Acuff: AcA, AcB	60+	0-14	Loam	CL	A-4 or A-6	100	100	95-100	60-75	0.63-2.0	0.13-0.15	6.6-7.8	Low.	B
		14-40	Sandy clay loam	CL	A-6	100	100	95-100	70-80	0.63-2.0	0.14-0.16	7.9-8.4	Low.	
		40-65	Sandy clay loam	CL	A-6	100	95-100	80-95	60-70	0.63-2.0	0.10-0.12	7.9-8.4	Low.	
Amarillo: AmA, AmB	60+	0-8	Fine sandy loam	SM or SC	A-4 or A-2	100	100	95-100	30-45	2.0-6.3	0.10-0.13	7.4-7.8	Low.	B
		8-43	Sandy clay loam	SC or CL	A-6	100	100	95-100	45-60	0.63-2.0	0.12-0.15	7.4-8.4	Low.	
		43-60	Sandy clay loam	SM or SC	A-4	100	90-99	80-95	35-45	0.63-2.0	0.11-0.13	7.9-8.4	Low.	
Berda: BeB, BeC	60+	0-8	Loam	SC or CL	A-6	100	95-100	80-95	40-60	0.63-2.0	0.14-0.17	7.9-8.4	Low.	B
		8-60	Clay loam	SC or CL	A-6	100	95-100	80-95	40-60	0.63-2.0	0.15-0.17	7.9-8.4	Low.	
Bippus: BpB	60+	0-22	Loam	CL	A-6	100	95-100	80-100	55-65	0.63-2.0	0.15-0.17	7.4-7.8	Low.	B
		22-64	Clay loam	CL	A-6	100	100	80-100	60-70	0.63-2.0	0.10-0.12	7.9-8.4	Low.	
Brownfield: BrC	60+	0-24	Fine sand	SP-SM or SM	A-2	100	100	95-100	5-15	6.3-20.00	0.05-0.07	6.1-6.5	Low.	A
		24-64	Sandy clay loam	SC	A-6	100	100	95-100	35-45	0.63-2.0	0.13-0.15	6.1-6.5	Low.	
		64-80	Fine sandy loam	SM-SC	A-2 or A-4	100	100	95-100	25-45	2.0-6.3	0.10-0.13	6.6-7.3	Low.	
Clairemont: Ca	60+	0-60	Silt loam	ML-CL or CL	A-6	100	100	100	85-98	0.63-2.0	0.16-0.18	7.9-8.4	Low.	B
Dalby: DaA	60+	0-38	Clay	CL or CH	A-7-6	100	98-100	90-100	80-95	<0.06	0.18-0.21	7.9-8.4	High.	D
		38-58	Silty clay loam	CL	A-7-6	100	95-100	95-100	75-95	0.06-0.20	0.18-0.20	7.9-8.4	Moderate.	
Drake: DrC	60+	0-7	Loam	CL	A-6	100	100	85-98	50-60	0.63-2.0	0.15-0.17	7.9-8.4	Low.	B
		7-60	Clay loam	CL	A-6	100	100	85-98	55-65	0.63-2.0	0.15-0.17	7.9-8.4	Low.	
*Latom. Mapped only in a complex with the Mobeetie soils.	4-20	0-12	Fine sandy loam	SM-SC	A-2	90-100	85-95	80-90	25-35	1/ 2.0-6.30	0.10-0.12	7.9-8.4	Low.	D
		12	Hard sandstone.											
*Lincoln: Ln, Lo. For the Yahola part of Lo, see the Yahola series.	60+	0-15	Loamy fine sand	SM	A-4	100	100	50-90	36-50	2.0-6.30	0.08-0.10	7.9-8.4	Low.	A
		15-64	Fine sand	SM	A-2	100	90-100	50-90	15-35	6.30-20.0	0.05-0.07	7.9-8.4	Low.	
Lubbock: LuA	60+	0-12	Clay loam	CL	A-6 or A-7	100	100	90-100	70-85	0.63-2.0	0.16-0.18	7.4-7.8	Moderate.	C
		12-38	Clay	CL or CH	A-7	100	100	90-100	85-90	0.06-0.20	0.18-0.20	7.4-8.4	Moderate.	
		38-60	Clay loam and sandy clay loam.	CL	A-6	100	100	85-100	70-85	0.63-2.0	0.13-0.17	7.9-8.4	Moderate.	

See footnote at end of table.

TABLE 3.--ESTIMATED ENGINEERING PROPERTIES--Continued

Soil series and map symbols	Depth to bedrock	Depth from surface	Classification: USDA texture	Classification: Unified	Classification: AASHO	Percentage passing sieve--No. 4 (4.7 mm.)	Percentage passing sieve--No. 10 (2.0 mm.)	Percentage passing sieve--Continued No. 40 (0.42 mm.)	Percentage passing sieve--Continued No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic group
	Inches	Inches								Inches per hour	Inches per inch of soil	pH		
Mansker: MaA, MaB, MaC--	60+	0-7	Loam---------------	CL	A-4	95-100	95-100	80-95	50-70	0.63-2.0	0.14-0.17	7.9-8.4	Low.	B
		7-19	Clay loam----------	CL	A-6	95-100	95-100	85-95	55-65	0.63-2.0	0.15-0.17	7.9-8.4	Low.	
		19-48	Loam---------------	CL	A-4	95-100	95-100	80-95	50-70	0.63-2.0	0.09-0.14	7.9-8.4	Low.	
*Miles: MfA, MfB, MfC, MlB, MmC. For the Springer part of MmC, see the Springer series	60+	0-9	Fine sandy loam----	SM	A-2, A-4	100	100	80-95	25-50	2.0-6.30	0.10-0.13	6.6-7.3	Low.	B
		9-70	Sandy clay loam----	SC or CL	A-6	100	100	90-97	45-60	0.63-2.0	0.13-0.15	6.6-7.8	Low.	
		70-76	Loam---------------	CL	A-4	100	100	90-97	50-60	0.63-2.0	0.12-0.14	7.9-8.4	Low.	
*Mobeetie: MnB, MnC, MoD, Mp. For the Latom part of MoD, see the Latom series; for the Potter part of Mp see the Potter series.	60+	0-10	Fine sandy loam----	SM	A-2	95-100	90-100	80-90	15-25	2.0-6.30	0.11-0.13	7.9-8.4	Low.	B
		10-64	Fine sandy loam and sandy clay loam.	SM or SC	A-4 or A-6	95-100	90-100	75-85	35-45	2.0-6.30	0.12-0.14	7.9-8.4	Low.	
Nobscot: NoC------------	60+	0-24	Fine sand----------	SP-SM	A-3	100	100	50-90	5-10	6.30-20.0	0.05-0.07	6.1-7.3	Low.	A
		24-48	Fine sandy loam----	SM or ML	A-2 or A-4	100	100	90-100	30-60	2.0-6.30	0.08-0.10	6.6-7.3	Low.	
		48-64	Fine sand----------	SP-SM	A-3	100	100	50-90	5-10	6.30-20.0	0.05-0.07	6.6-7.3	Low.	
Olton: OcA, OcB, OlA, OlB.	60+	0-8	Loam---------------	CL	A-6	100	100	85-95	60-75	0.63-2.0	0.16-0.18	7.4-7.8	Low.	C
		8-65	Clay loam----------	CL	A-6	100	100	90-100	70-90	0.20-0.63	0.18-0.20	7.4-8.4	Moderate.	
Portales: PoA, PoB------	60+	0-11	Loam---------------	CL	A-6	95-100	95-100	85-95	50-65	0.63-2.0	0.13-0.15	7.9-8.4	Low.	B
		11-32	Clay loam----------	CL, SC	A-6	95-100	90-100	85-95	45-55	0.63-2.0	0.14-0.15	7.9-8.4	Low.	
		32-60	Sandy clay loam----	SC or CL	A-6	90-100	90-100	85-95	45-55	0.63-2.0	0.08-0.10	7.9-8.4	Low.	
Potter: PtC-------------	60+	0-8	Clay loam----------	ML or CL	A-4 or A-6	90-95	70-85	60-85	50-60	0.63-2.0	0.13-0.15	7.9-8.4	Low.	C
		8-18	Clay loam and platy caliche.	GM, GC, SM or SC.	A-2, A-4, or A-6	30-80	25-75	20-60	12-50	0.63-2.0	<0.02	7.9-8.4	Low.	
Randall: Ra-------------	60+	0-60	Clay---------------	CH	A-7	100	100	90-100	75-92	<0.06	0.16-0.18	7.4-8.4	High.	D
*Spade: SeB, SeC--------- For the Veal part of SeB and SeC, see the Veal series.	20-48	0-32	Fine sandy loam----	SM-SC	A-4	95-100	95-100	70-85	40-50	2.0-6.30	0.10-0.12	7.9-8.4	Low.	B
		32-48	Weakly cemented sandstone.											
*Springer---------------- Mapped only in a complex with the Miles soils.	60+	0-16	Loamy fine sand----	SM	A-2	100	100	70-85	15-25	2.0-6.30	0.06-0.08	6.6-7.3	Low.	B
		16-38	Fine sandy loam----	SM-SC	A-2	100	100	80-90	20-35	2.0-6.30	0.07-0.10	6.6-7.3	Low.	
		38-64	Loamy fine sand----	SM	A-2	100	100	70-85	15-25	2.0-6.30	0.06-0.08	6.6-7.3	Low.	
Spur: Sp, Su------------	60+	0-34	Clay loam----------	CL	A-6	100	100	95-100	75-95	0.63-2.0	0.13-0.17	7.9-8.4	Low.	B
		34-64	Loam---------------	SM or SC	A-4 or A-6	100	100	85-95	35-45	0.63-2.0	0.08-0.10	7.9-8.4	Low.	

TABLE 3.--ESTIMATED ENGINEERING PROPERTIES--Continued

Soil series and map symbols	Depth to bedrock	Depth from surface	Classification			Percentage passing sieve--		Percentage passing sieve--Continued		Permeability	Available water capacity	Reaction	Shrink-swell potential	Hydrologic group
			USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
	Inches	Inches								Inches per hour	Inches per inch of soil	pH		
*Tivoli: Tv, Tw----------. For the Brownfield part of Tw, see the Brownfield series.	60+	0-60	Fine sand----------	SP-SM or SM	A-2 or A-3	100	100	65-80	5-15	6.30-20.0	0.04-0.07	6.6-8.4	Low.	A
*Veal--------------------. Mapped only in associations with the Spade soils.	60+	0-8 8-18 18-48	Fine sandy loam---- Sandy clay loam---- Clay loam----------	SM-SC CL CL	A-4 A-6 A-6	95-100 95-100 95-100	95-100 95-100 80-95	85-95 90-100 70-95	40-50 50-60 50-60	2.0-6.30 0.63-2.0 0.63-2.0	0.10-0.12 0.12-0.15 0.05-0.07	7.9-8.4 7.9-8.4 7.9-8.4	Low. Low. Low.	B
*Vernon: Vb, VeB, VeC, Vh. Properties for Vernon soils only. Properties for Badland part of Vb not estimated.	60+	0-7 7-40	Clay loam---------- Clay and partially weathered red beds.	CL CL or CH	A-6 A-6 or A-7	98-100 98-100	94-100 95-100	80-95 80-95	55-65 55-85	0.20-0.63 <0.06	0.15-0.17 0.16-0.18	7.9-8.4 7.9-8.4	Moderate. High.	D
*Yahola------------------. Mapped only in a complex with the Lincoln soils.	60+	0-7 7-30 30-48	Fine sandy loam---- Silt loam---------- Loamy fine sand stratified with fine sand.	SM or SC ML SM or SC	A-4 or A-6 A-4 A-2	100 100 100	100 100 100	70-85 90-100 65-95	40-50 55-70 25-35	2.0-6.30 2.0-6.30 6.30-20.00	0.10-0.12 0.10-0.12 0.08-0.10	7.9-8.4 7.9-8.4 7.9-8.4	Low. Low. Low.	B
Zita: ZtA----------------	60+	0-7 7-60	Loam--------------- Clay loam----------	CL CL	A-4 or A-6 A-6	100 100	100 98-100	98-100 95-99	50-60 60-70	0.63-2.0 0.63-2.0	0.14-0.18 0.16-0.18	6.6-7.3 6.6-8.4	Low. Low.	B

1/ This soil has moderately rapid permeability in the upper 12 inches but has slow permeability in the hard sandstone.

TABLE 4.--ENGINEERING INTERPRETATIONS OF SOILS

[Properties of Badland (Ba) and Rough broken land (Ro) are too variable to be estimated. An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series]

Soil and map symbol	Suitability as source of--		Degree of limitation and soil features affecting--				Degree of limitation and soil features affecting--Cont.		Soil features affecting--			Corrosivity class and contributing soil features for--	
							Farm ponds						
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	Reservoir areas	Embankments	Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
Abilene: AbA-----	Fair: clay loam texture.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight------	Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Slow intake rate.	All features favorable.	All features favorable.	High: texture-	Low.
Acuff: AcA, AcB--	Fair: 4 to 12 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight--------	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight-------	All features favorable.	All features favorable.	All features favorable.	Moderate: sandy clay loam texture.	Low.
Amarillo: AmA, AmB.	Fair: 6 to 15 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight--------	Slight---------	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Slopes---------	All features favorable.	All features favorable.	Moderate: sandy clay loam texture.	Low.
Berda: BeB, BeC--	Fair: 6 to 18 inches of loam material.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight--------	Slight--------	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Slopes---------	Highly erodible.	Highly erodible.	Moderate: conductivity.	Low.
Bippus: BpB------	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight--------	Slight--------	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Moderate intake rate.	Receives outside water.	All features favorable.	Moderate: clay loam texture.	Low.
Brownfield: BrC--	Poor: fine sand texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight--------	None to slight.	Moderate: moderate permeability.	Severe: seepage.	Severe: poor slope stability; poor resistance to piping and erosion.	High intake rate.	Highly erodible.	Highly erodible.	Moderate: sandy clay loam texture.	Low.
Clairemont: Ca---	Good-----------	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Subject to flooding.	Subject to flooding.	Subject to flooding.	Low-----------	Low.
Dalby: DaA-------	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight------	Slight---------	Severe: poor resistance to piping and erosion.	Very slow intake rate.	Clay texture--	Difficult to establish needed plants.	Moderate: clay loam texture.	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS OF SOILS--Continued

Soil and map symbol	Suitability as source of--		Degree of limitation and soil features affecting--				Degree of limitation and soil features affecting--Con.		Soil features affecting--			Corrosivity class and contributing soil features for--	
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	Farm ponds: Reservoir areas	Farm ponds: Embankments	Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
Drake: DrC-------	Fair: 6 to 10 inches of loam materi- al.	Fair: fair traffic- supporting capacity.	Moderate: fair traffic- supporting capacity.	Slight--------	None to slight.	Moderate: moderate permeabil- ity.	Moderate: moderate permeabil- ity.	Moderate: poor re- sistance to piping and erosion.	Moderate intake rate; slope.	Highly erodi- ble.	Highly erodi- ble.	High: conductivity.	Low.
*Latom-------------- Mapped only in a complex with Mobeetie soils.	Poor where fine sandy loam is 4 to 6 inches thick. Fair where fine sandy loam is 6 to 20 inches thick.	Poor: 4 to 20 inches of material.	Severe: 4 to 20 inches to bedrock.	Severe: 4 to 20 inches to bedrock.	Severe: 4 to 20 inches to bedrock.	Severe: 4 to 20 inches to bedrock.	Severe: 4 to 20 inches to bedrock.	Severe: 4 to 20 inches to bedrock.	4 to 20 inches to bedrock.	4 to 20 inches to bedrock.	4 to 20 inches to bedrock.	Low------------	Low.
*Lincoln: Ln, Lo--- For Yahola part of Lo, see the Yahola series.	Poor: loamy fine sand texture.	Good----------	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: rapid permeabil- ity.	Severe: rapid permeabil- ity.	Moderate: poor re- sistance to piping and erosion.	High water table; slight to strong salinity.	Severe hazard of soil blowing; sand texture.	Highly erodi- ble.	Low------------	Low.
Lubbock: LuA------	Fair: clay loam texture.	Poor: poor traffic- supporting capacity.	Severe: poor traffic- supporting capacity.	Moderate: moderate shrink-swell potential.	Severe: slow permeabil- ity.	Moderate: slow perme- ability.	Slight--------	Moderate: fair slope stability.	Slow intake rate.	All features favorable.	All features favorable.	High: conductivity.	Low.
Mansker: MaA, MaB, MaC.	Fair: 7 to 9 inches of loam materi- al.	Fair: fair traffic- supporting capacity.	Moderate: fair traffic- supporting capacity.	Slight--------	Slight-------	Moderate: moderate permeabil- ity.	Moderate: moderate permeabil- ity.	Moderate: fair stabil- ity; fair resistance to piping and erosion.	12 to 20 inches to caliche.	All features favorable.	All features favorable.	High: conductivity.	Low.
Miles: MfA, MfB, MfC----	Fair: 7 to 20 inches of fine sandy loam materi- al.	Fair: fair traffic- supporting capacity.	Moderate: fair traffic- supporting capacity.	Slight--------	Slight-------	Moderate: moderate permeabil- ity.	Moderate: moderate permeabil- ity.	Moderate: poor re- sistance to piping and erosion.	Slope----------	All features favorable.	All features favorable.	Moderate: sandy clay loam texture.	Low.
* MlB, MmC--------- For the Springer part of MmC, see the Springer series.	Poor: loamy fine sand texture.	Fair: fair traffic- supporting capacity.	Moderate: fair traffic- supporting capacity.	Slight--------	Slight--------	Moderate: moderate permeabil- ity.	Moderate: moderate permeabil- ity.	Moderate: poor re- sistance to piping and erosion.	Rapid intake rate.	High hazard of soil blowing.	High hazard of soil blowing.	Moderate: sandy clay loam texture.	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS OF SOILS--Continued

Soil and map symbol	Suitability as source of--		Degree of limitation and soil features affecting				Degree of limitation and soil features affecting--Con.		Soil features affecting--			Corrosivity class and contributing soil features for--	
							Farm ponds						
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	Reservoir areas	Embankments	Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
*Mobeetie: MnB, MnC, MoD, Mp---------- For the Latom part of MoD, see the Latom series; for the Potter part of Mp, see the Potter series.	Good----------	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity. Severe where slopes are 15 to 20 percent.	Slight where slopes are 1 to 6 percent; moderate where slopes are 6 to 15 percent; severe where slopes are 15 to 20 percent.	None to slight where slopes are 1 to 5 percent; moderate where slopes are 5 to 10 percent; severe where slopes are 10 to 20 percent.	Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderate intake rate.	Moderate hazards of water erosion and soil blowing.	Highly erodible; steep slopes.	High: conductivity.	Low.
Nobscot: NoC------	Poor: fine sand texture.	Good---------	Slight--------	Slight-------	Slight--------	Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Rapid intake rate.	Severe hazard of soil blowing; undulating topography.	Severe hazard of soil blowing.	Low-----------	Low.
Olton: OcA, OcB, OlA, OlB.	Fair: 5 to 12 inches of loam.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight------	Moderate: moderately slow permeability.	Moderate: medium compressibility.	Slow intake rate.	All features favorable.	All features favorable.	High: clay loam texture.	Low.
Portales: PoA, PoB.	Fair: 11 to 20 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight-------	Slight--------	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: medium compressibility.	All features favorable.	All features favorable.	All features favorable.	High: corrosivity.	Low.
Potter: PtC-------	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; 0 to 15 percent slopes. Severe where slopes are more than 15 percent.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 15 percent; severe where slopes are more than 15 percent.	Slight where slopes are 0 to 5 percent; moderate where slopes are 5 to 10 percent; severe where slopes are more than 15 percent.	Moderate: moderate permeability; slope of 2 to 7 percent. Severe: slopes of more than 7 percent.	Severe: permeability; calcareous substratum.	Moderate: poor resistance to piping and erosion.	Nonarable-----	Nonarable-----	Nonarable----	High: corrosivity.	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS OF SOILS--Continued

Soil and map symbol	Suitability as source of-- Topsoil	Suitability as source of-- Road fill	Degree of limitation and soil features affecting-- Highway location	Degree of limitation and soil features affecting-- Foundations for low buildings	Degree of limitation and soil features affecting-- Septic tank filter fields	Degree of limitation and soil features affecting-- Sewage lagoons	Degree of limitation and soil features affecting--Con. Farm ponds: Reservoir areas	Degree of limitation and soil features affecting--Con. Farm ponds: Embankments	Soil features affecting-- Irrigation	Soil features affecting-- Terraces and diversions	Soil features affecting-- Waterways	Corrosivity class and contributing soil features for-- Uncoated steel	Corrosivity class and contributing soil features for-- Concrete
*Randall: Ra------	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight------	Slight--------	Moderate: high compressibility.	Slow intake rate.	Depressional topography.	All features favorable.	High: clay texture.	Low.
Spade: SeB, SeC-- For the Veal part of SeB and SeC, see the Veal series.	Good----------	Fair: fair traffic-supporting capacity.	Moderate: bedrock at depth of 20 to 48 inches; fair traffic-supporting capacity.	Slight-------	Severe: bedrock at depth of 20 to 48 inches.	Severe: bedrock at depth of 20 to 48 inches.	Severe: bedrock at depth of 20 to 48 inches moderate permeability.	Moderate: poor resistance to piping and erosion.	Bedrock at depth of 20 to 48 inches.	Bedrock at depth of 20 to 48 inches.	Bedrock at depth of 20 to 48 inches.	High: corrosivity.	Low.
*Springer----------- Mapped only in a complex with Miles soils.	Poor: loamy fine sand texture.	Good---------	Slight---------	Slight-------	Slight--------	Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Rapid intake rate.	Severe hazard of soil blowing; undulating and hummocky topography.	Severe hazard of soil blowing.	Low-----------	Low.
Spur: Sp, Su------	Fair: clay loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: medium compressibility.	Subject to flooding.	Subject to flooding.	Subject to flooding.	Moderate: conductivity.	Low.
*Tivoli: Tv, Tw---- For the Brownfield part of Tw, see the Brownfield series.	Poor: fine sand texture.	Good----------	Moderate where slopes are 6 to 15 percent; severe where slopes are 15 to 30 percent.	Moderate where slopes are 6 to 15 percent; severe where slopes are 15 to 30 percent.	Severe: inadequate filtration.	Severe: rapid permeability.	Severe: rapid permeability.	Severe: poor resistance to piping and erosion; poor stability.	High intake rate; low available water capacity; dune topography.	Dune topography; severe hazard of soil blowing.	Severe hazard of soil blowing.	Low-----------	Low.
*Veal-------------- Mapped only in association with the Spade soils.	Fair: 5 to 10 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight--------	Slight-------	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Undulating topography; moderately deep soil.	Undulating topography; moderately deep soil.	Undulating topography; moderately deep soil.	High: corrosivity.	Low.

TABLE 4.--ENGINEERING INTERPRETATIONS OF SOILS--Continued

Soil and map symbol	Suitability as source of--		Degree of limitation and soil features affecting--				Degree of limitation and soil features affecting--Con.		Soil features affecting--			Corrosivity class and contributing soil features for--	
							Farm ponds						
	Topsoil	Road fill	Highway location	Foundations for low buildings	Septic tank filter fields	Sewage lagoons	Reservoir areas	Embankments	Irrigation	Terraces and diversions	Waterways	Uncoated steel	Concrete
*Vernon: Vb, VeB, VeC, Vh. Properties for Vernon soils only. Properties for Badland part of Vb not estimated.	Poor: clay texture.	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate: where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight--------	Moderate: high compressibility; poor stability.	Slow intake rate; erodible.	Erodible------	Erodible------	High: clay texture.	Low.
*Yahola------------ Mapped only in a complex with Lincoln soils.	Good---------	Fair: fair traffic-supporting capacity.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: moderately rapid permeability.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Moderately rapid permeability; subject to flooding.	Subject to flooding.	Subject to flooding.	Low-----------	Low.
Zita: ZtA--------	Fair: 11 to 20 inches of loam material.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight--------	Slight--------	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.	High: corrosivity.	Low.

TABLE 5.--ENGINEERING TEST DATA

[Tests performed by the Texas Highway Department in accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Soil name and location	Parent material	Texas report No.	Depth	Specific gravity	Shrinkage			Mechanical analysis 1/								Liquid limit	Plasticity index	Classification	
								Percentage passing sieve--					Percentage smaller than--						
					Limit	Ratio	Lineal	3/8-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			AASHO 2/	Unified 3/
			Inches		Percent		Percent									Percent			
Dalby clay:																			
8.3 miles SE. of Post and 5.85 miles E. of U.S. Highway No. 84 and 1,200 feet SE. of ranch road (Modal).	Alluvium.	64-238-R	6-38	2.83	12	1.98	24.8	---	---	100	99	95	95	80	69	80	57	A-7-6(20)	CH
		64-239-R	38-58	2.73	11	2.00	15.5	---	---	100	98	79	75	45	37	44	28	A-7-6(16)	CL
4.7 miles E. of Post and 50 feet N. of U.S. Highway No. 380 (Clayey C horizon).	Alluvium.	64-242-R	6-28	2.75	10	2.03	18.0	---	100	98	94	89	88	60	48	50	33	A-7-6(18)	CL
		64-243-R	28-35	2.69	12	1.97	16.0	---	100	99	96	92	88	48	40	48	31	A-7-6(18)	CL
Vernon clay loam (from an area of Vernon soils):																			
7.4 miles SE. of Post and 0.3 miles SW. of U.S. Highway No. 84 and across railroad (Modal).	Clayey red beds of Triassic and Permian age.	64-240-R	7-18	2.69	10	2.02	18.0	100	99	95	82	64	63	44	37	50	35	A-7-6(15)	CL
		64-241-R	18-30	2.83	11	2.12	25.1	---	100	99	95	85	84	59	47	76	48	A-7-6(20)	CH
3.3 miles N. of U.S. Highway No. 380 and 100 feet E. of Farm Road 651 (Less clayey AC horizon).	Clayey red beds of Triassic and Permian age.	64-247-R	6-21	2.66	14	1.89	9.2	100	99	94	87	55	49	26	21	32	17	A-6(7)	CL

1/ Mechanical analyses according to the AASHO Designation T-88-57 (1). Results by this procedure may differ somewhat from results that were obtained by the soil survey procedure or the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

2/ Based on AASHO Designation M 145-49 (1).

3/ Based on the Unified Soil Classification System (8).

TABLE 6.--CLASSIFICATION OF SOIL SERIES

Series	Family	Subgroup	Order
Abilene 1/	Fine, mixed, thermic	Pachic Argiustolls	Mollisols.
Acuff	Fine-loamy, mixed, thermic	Aridic Paleustolls	Mollisols.
Amarillo	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Berda	Fine-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Bippus 2/	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Brownfield	Loamy, mixed, thermic	Arenic Aridic Paleustalfs	Alfisols.
Clairemont	Fine-silty, mixed, calcareous, thermic	Typic Ustifluvents	Entisols.
Dalby	Fine, mixed, thermic	Typic Torrerts	Vertisols.
Drake	Fine-loamy, mixed, calcareous, thermic	Typic Ustorthents	Entisols.
Latom	Loamy, mixed, calcareous, thermic	Lithic Ustic Torriorthents	Entisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Lubbock	Fine, mixed, thermic	Aridic Pachic Argiustolls	Mollisols.
Mansker 3/	Fine-loamy, mixed, thermic	Aridic Calciustolls	Mollisols.
Miles	Fine-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Mobeetie 4/	Coarse-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Nobscot	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols.
Olton	Fine, mixed, thermic	Aridic Paluestolls	Mollisols.
Portales	Fine-loamy, mixed, thermic	Aridic Calciustolls	Mollisols.
Potter	Loamy, carbonatic, thermic, shallow	Ustollic Calciorthids	Aridisols.
Randall	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Spade	Coarse-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Springer 5/	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Spur 6/	Fine-loamy, mixed, thermic	Fluventic Haplustolls	Mollisols.
Tivoli 7/	Mixed, thermic	Typic Ustipsamments	Entisols.
Veal	Fine-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Vernon	Fine, mixed, thermic	Typic Ustochrepts	Inceptisols.
Yahola	Coarse-loamy, mixed, calcareous, thermic	Typic Ustifluvents	Entisols.
Zita	Fine-loamy, mixed, thermic	Aridic Haplustolls	Mollisols.

1/ The soils of Garza County named for this series are outside the range of the series because they have a higher chroma at depth below 44 inches.

2/ The soils of Garza County named for this series are outside the range of the series because the surface layer is more alkaline.

3/ The soils of Garza County named for this series are outside the range of the series because the layer at a depth of 7 to 19 inches contains less calcium carbonate.

4/ The soils of Garza County named for this series are outside the range of the series because the texture at a depth below 36 inches is more clayey.

5/ The soils of Garza County named for this series are outside the range of the series because the texture at depths between 38 and 64 inches is more sandy.

6/ The soils of Garza County named for this series are outside the range of the series because the hue at a depth below 16 inches is more red.

7/ The soils of Garza County named for this series are outside the range of the series because the hue of the underlying material is more yellow and more alkaline.

TABLE 7.--PRECIPITATION DATA

Month	Average total	Greatest daily--		Total of 1/--		1 year in 10 will have--		Average number of days with precipitation of 2/--			Snow and sleet		
		Amount	Year of occurrence	Driest year (1956)	Wettest year (1941)	Less than--	More than--	0.10 inch or more	0.50 inch or more	1.00 inch or more	Average total	Greatest monthly	Year of occurrence
	Inches	Inches		Inches	Inches	Inches	Inches				Inches	Inches	
January-------	0.75	2.60	1939	0.02	1.47	0	1.58	2	(3/)	0	1.2	6.0	1936
February------	.68	1.19	1957	.55	2.00	0	1.58	2	(3/)	(3/)	1.2	8.0	1938
March---------	.60	1.24	1941	0	3.62	(4/)	1.53	1	(3/)	0	.4	6.0	1947
April---------	1.36	2.96	1954	.09	5.18	.04	3.45	2	1	1	(3/)	1.0	1938
May-----------	3.12	2.59	1963	2.33	10.81	.31	5.53	5	2	1	0	0	----
June----------	2.76	5.56	1963	.44	2.00	.28	6.74	5	2	1	0	0	----
July----------	2.42	4.20	1955	.68	3.20	.19	4.76	3	2	1	0	0	----
August--------	1.52	4.35	1946	(4/)	1.85	.02	3.20	2	1	0	0	0	----
September-----	2.08	2.95	1936	.01	5.02	(4/)	4.48	3	1	(3/)	0	0	----
October-------	2.05	2.70	1960	.46	7.24	.26	4.99	4	2	1	0	0	5/----
November------	.78	1.37	1963	(4/)	.23	0	1.91	2	1	(3/)	.1	2.0	1943
December------	.70	1.53	1942	.41	.58	0	1.77	1	(3/)	(3/)	1.6	12.8	1942
Year----------	18.82	----	-----	4.99	43.20	11.15	26.55	32	12	5	4.5	----	----

1/ Record for period 1911-1963.
2/ Based on 10-year average, 1954-1963.
3/ Less than one-half day.
4/ Trace.
5/ Also in earlier years.

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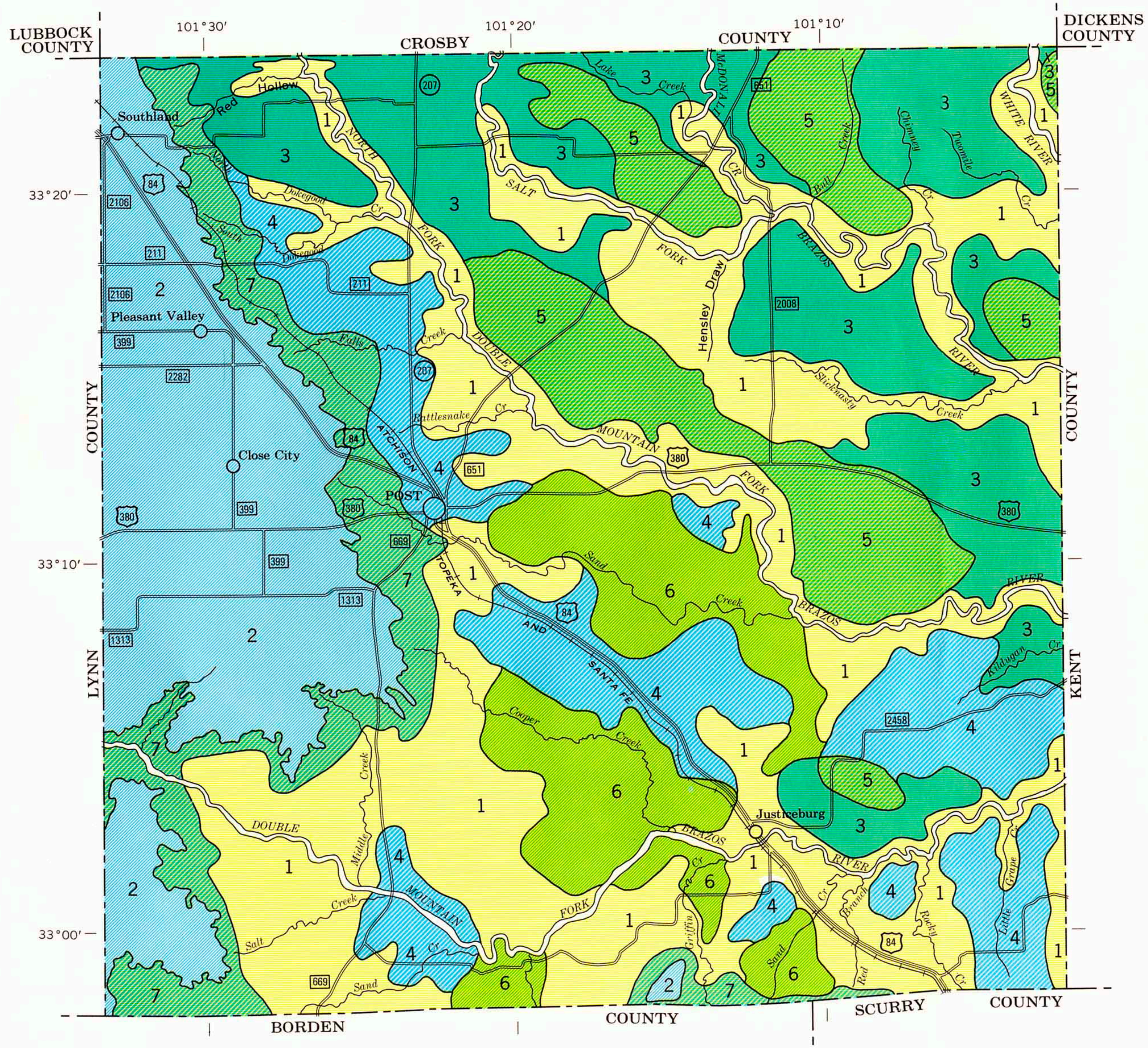
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

GARZA COUNTY, TEXAS

Scale 1:253,440

N



SOIL ASSOCIATIONS *

1 Vernon-Rough broken land association: Gently sloping to steep, moderately deep clay loams, and rough broken land

2 Olton-Acuff association: Nearly level to gently sloping, deep loams

3 Miles association: Nearly level to gently sloping, deep fine sandy loams

4 Olton-Vernon association: Nearly level to gently sloping, moderately deep and deep clay loams

5 Brownfield-Miles association: Nearly level to gently sloping and undulating, deep fine sands and loamy fine sands

6 Dalby association: Nearly level to gently sloping, deep clays

7 Mobeetie-Berda-Rough broken land association: Gently sloping to steep, deep fine sandy loams and loams, and rough broken land

* Texture as used in this legend refers to the surface layer.

Compiled 1973

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

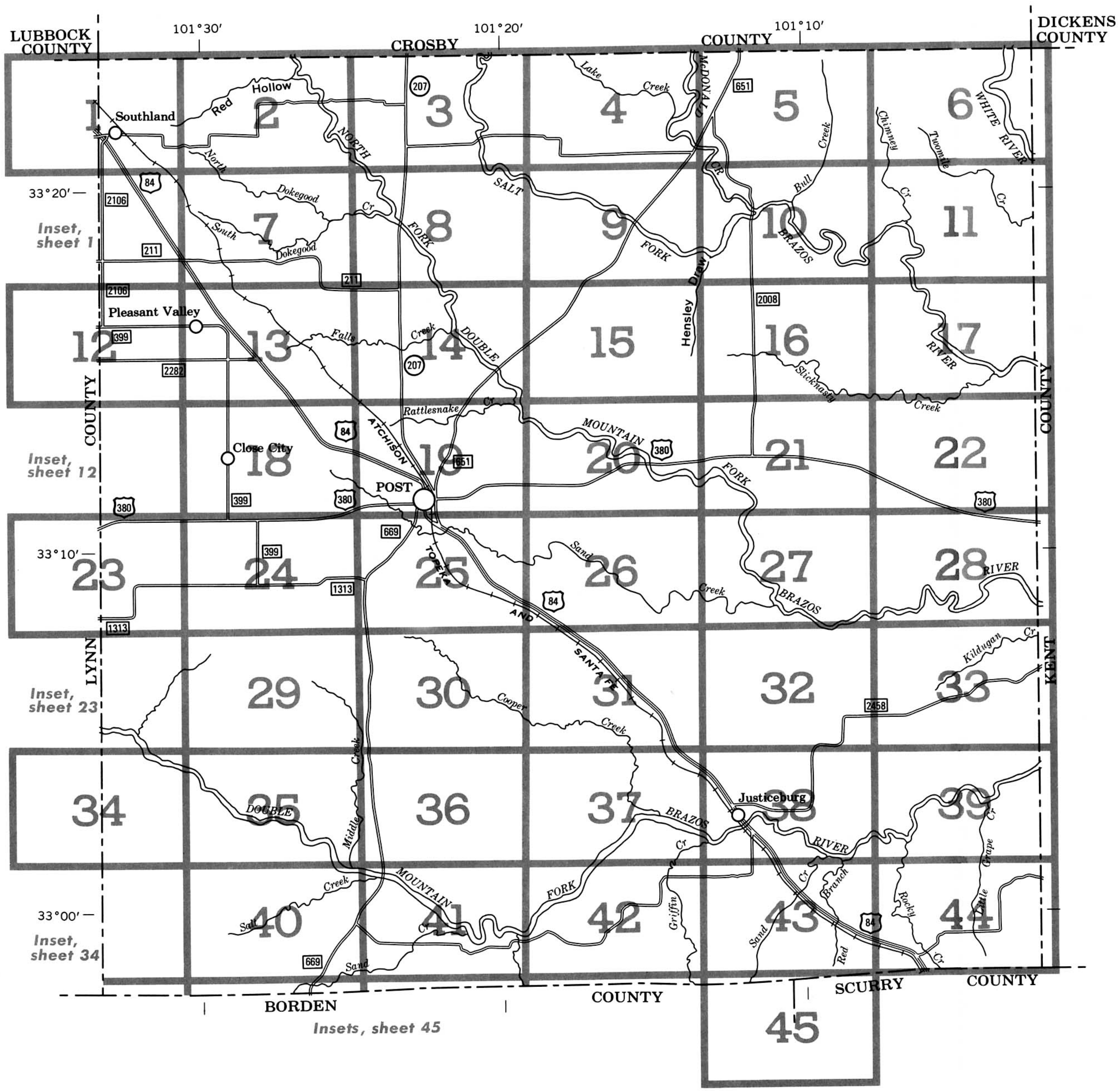
INDEX TO MAP SHEETS

GARZA COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

N



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, or D, shows the class of slope. Most symbols without a slope letter are for nearly level soils or land types, but some are for soils or land types that have a considerable range in slope. (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
AbA	Abilene clay loam, 0 to 1 percent slopes
AcA	Acuff loam, 0 to 1 percent slopes
AcB	Acuff loam, 1 to 3 percent slopes
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes
Ba	Badland
BeB	Berda loam, 1 to 3 percent slopes
BeC	Berda loam, 3 to 5 percent slopes
BpB	Bippus loam, 1 to 3 percent slopes
BrC	Brownfield fine sand, 1 to 5 percent slopes (W)
Ca	Clairemont silt loam
DaA	Dalby clay, 0 to 2 percent slopes
DrC	Drake soils, 2 to 5 percent slopes (W)
Ln	Lincoln soils (W)
Lo	Lincoln-Yahola complex
LuA	Lubbock clay loam, 0 to 1 percent slopes
MaA	Mansker loam, 0 to 1 percent slopes
MaB	Mansker loam, 1 to 3 percent slopes
MaC	Mansker loam, 3 to 5 percent slopes
MfA	Miles fine sandy loam, 0 to 1 percent slopes
MfB	Miles fine sandy loam, 1 to 3 percent slopes
MfC	Miles fine sandy loam, 3 to 5 percent slopes
MlB	Miles loamy fine sand, 0 to 3 percent slopes (W)
MmC	Miles-Springer loamy fine sands, 3 to 5 percent slopes (W)
MnB	Mobeetie fine sandy loam, 1 to 3 percent slopes
MnC	Mobeetie fine sandy loam, 3 to 5 percent slopes
MoD	Mobeetie-Latom fine sandy loams, 2 to 20 percent slopes
Mp	Mobeetie-Potter association, rolling
NoC	Nobscot fine sand, 0 to 5 percent slopes (W)
OcA	Olton clay loam, 0 to 1 percent slopes
OcB	Olton clay loam, 1 to 3 percent slopes
OlA	Olton loam, 0 to 1 percent slopes
OlB	Olton loam, 1 to 3 percent slopes
PoA	Portales loam, 0 to 1 percent slopes
PoB	Portales loam, 1 to 3 percent slopes
PtC	Potter soils, 0 to 5 percent slopes
Ra	Randall clay
Ro	Rough broken land
SeB	Spade and Veal fine sandy loams, 1 to 3 percent slopes
SeC	Spade and Veal fine sandy loams, 3 to 5 percent slopes
Sp	Spur clay loam
Su	Spur fine sandy loam
Tv	Tivoli fine sand (W)
Tw	Tivoli-Brownfield soils, rolling (W)
Vb	Vernon-Badland complex, hilly
VeB	Vernon soils, 1 to 3 percent slopes
VeC	Vernon soils, 3 to 5 percent slopes
Vh	Vernon complex, hilly
ZtA	Zita loam, 0 to 1 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Fence

Cotton gin

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Well, irrigation

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

1

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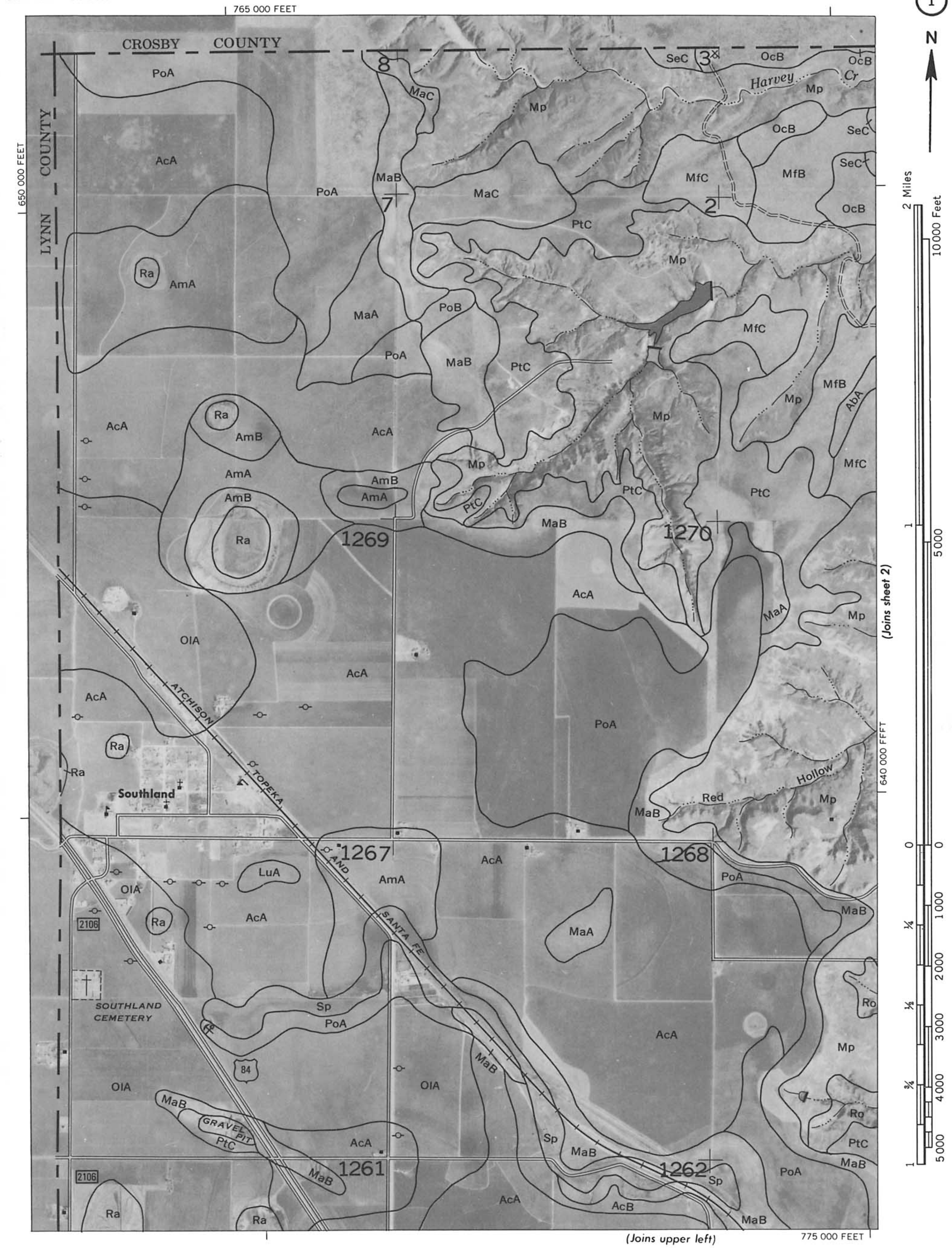
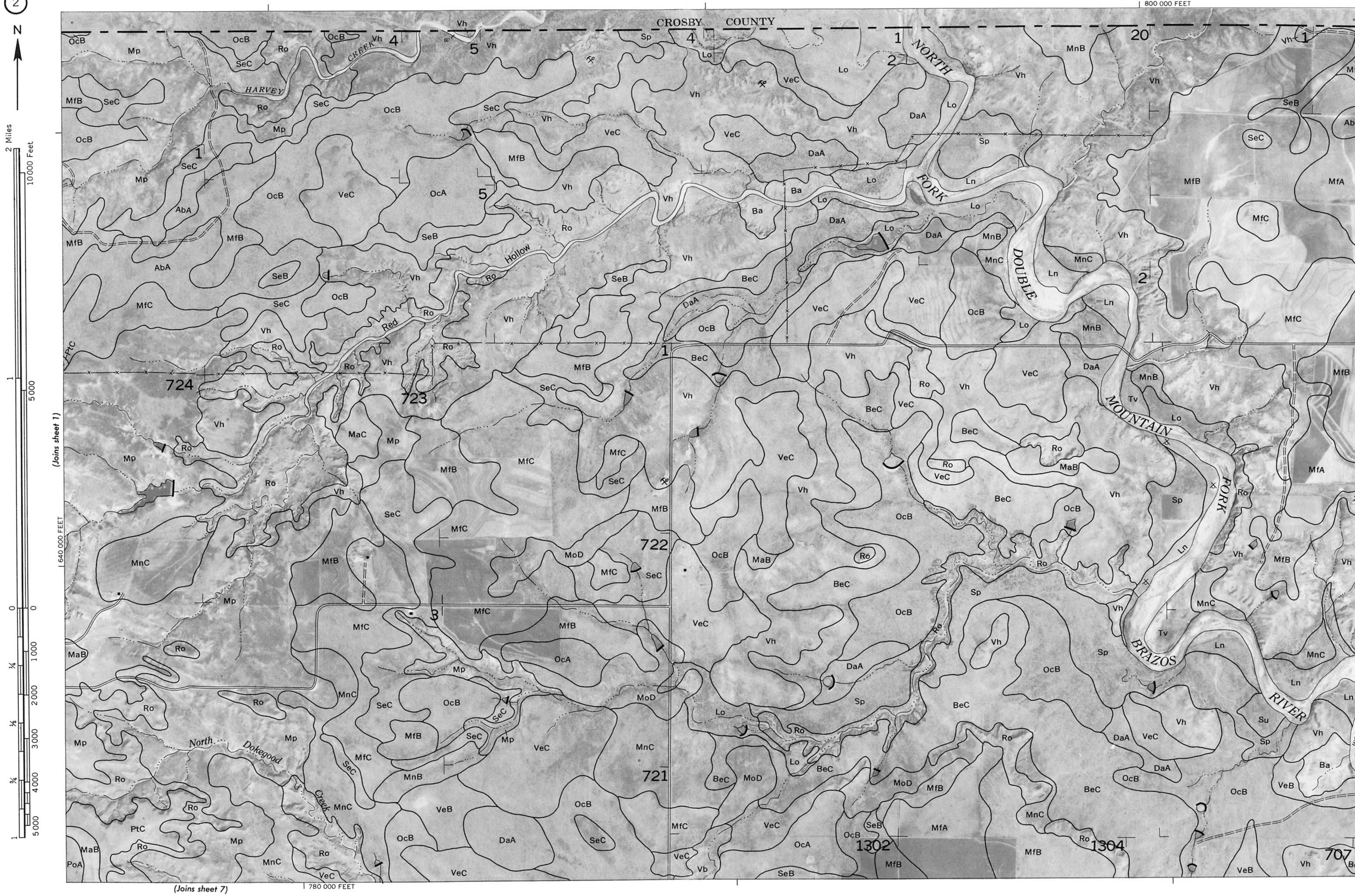


GARZA COUNTY, TEXAS — SHEET NUMBER 2



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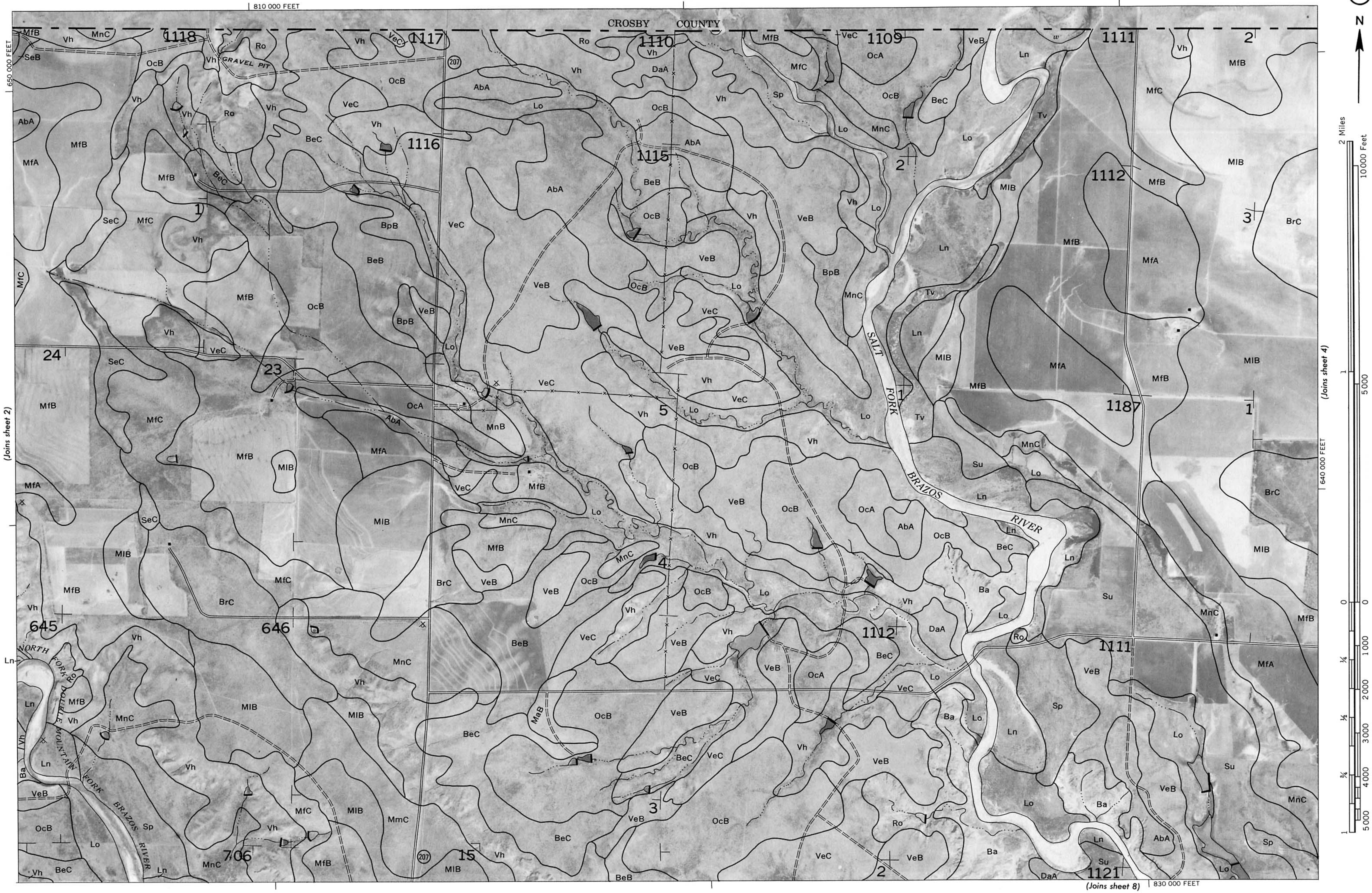

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GARZA COUNTY, TEXAS — SHEET NUMBER 4

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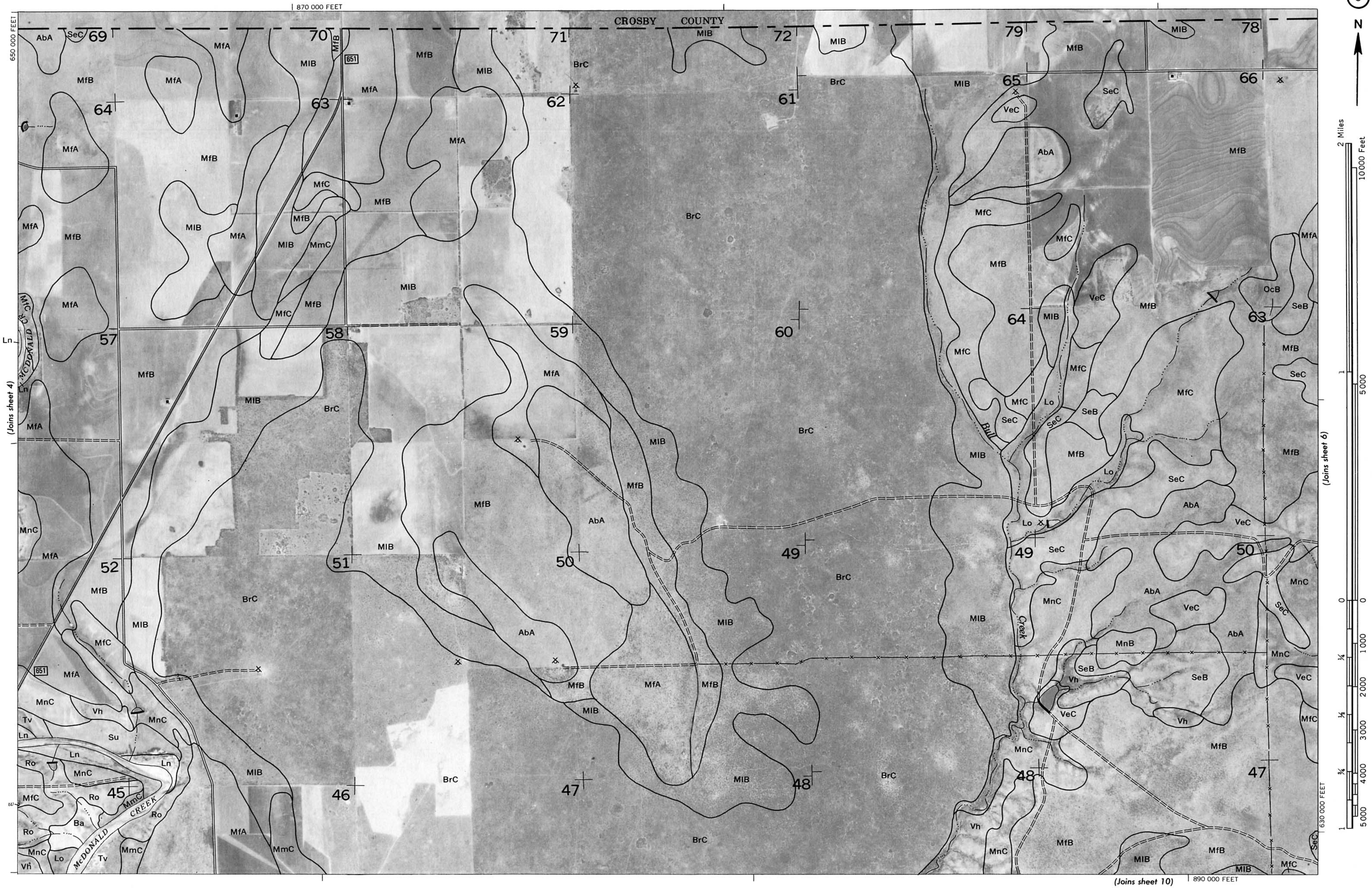
GARZA COUNTY, TEXAS — SHEET NUMBER 5



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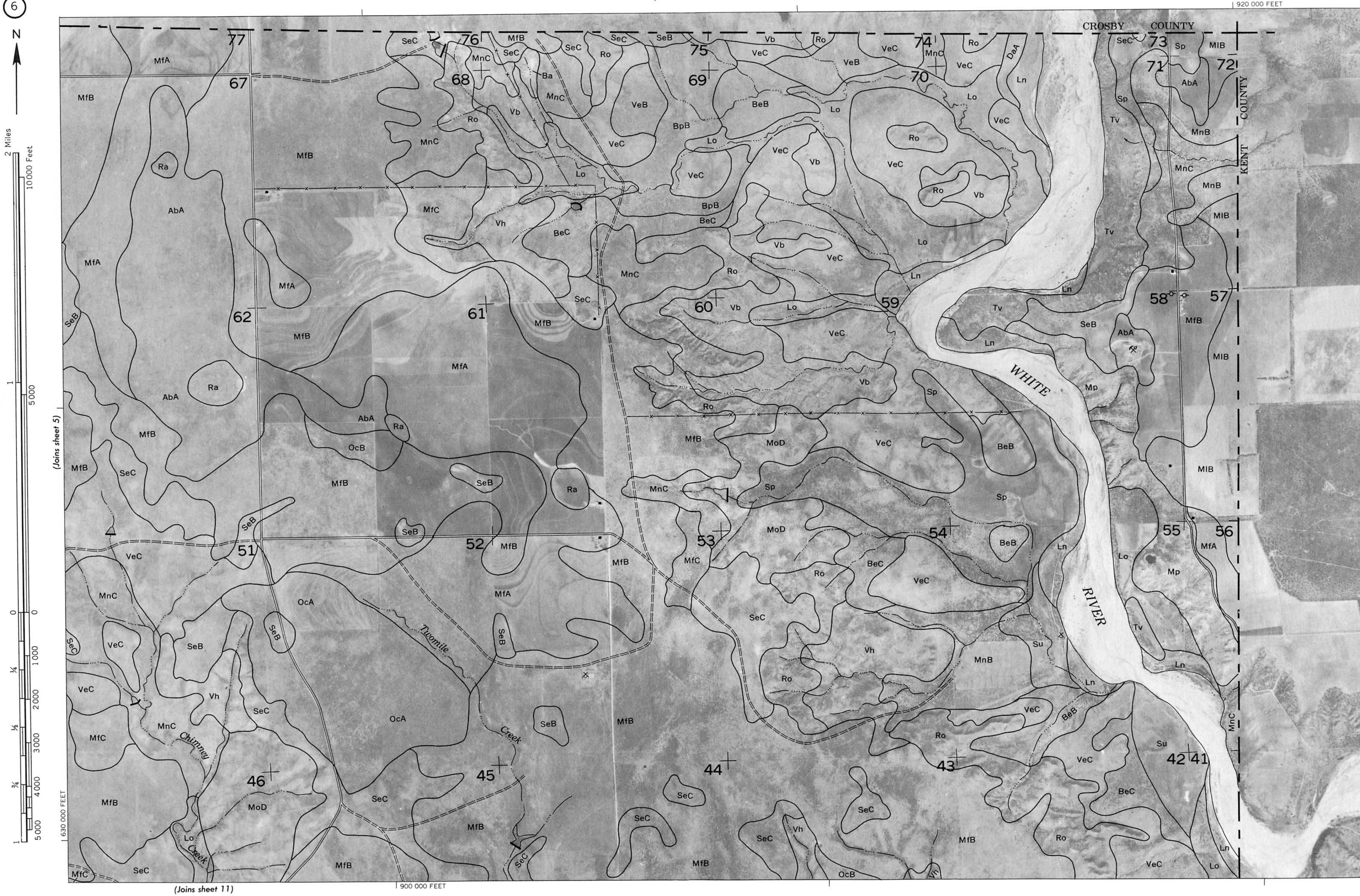

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GARZA COUNTY, TEXAS — SHEET NUMBER 8

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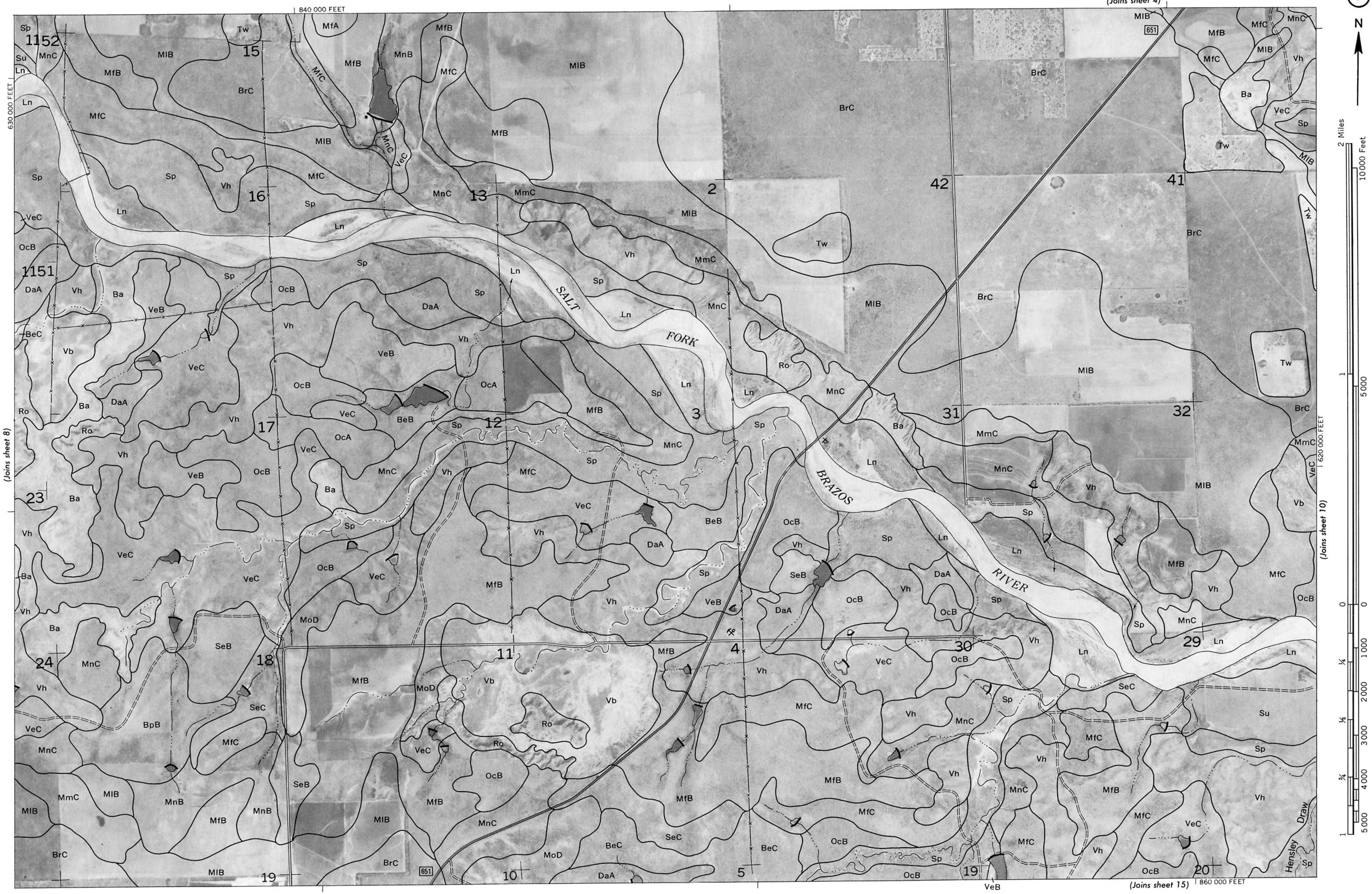
(Joins sheet 4)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 15)
840 000 FEET
860 000 FEET
630 000 FEET
620 000 FEET
SALT FORK
BRAZOS RIVER
Hensley Draw
N
2 Miles
10 000 Feet
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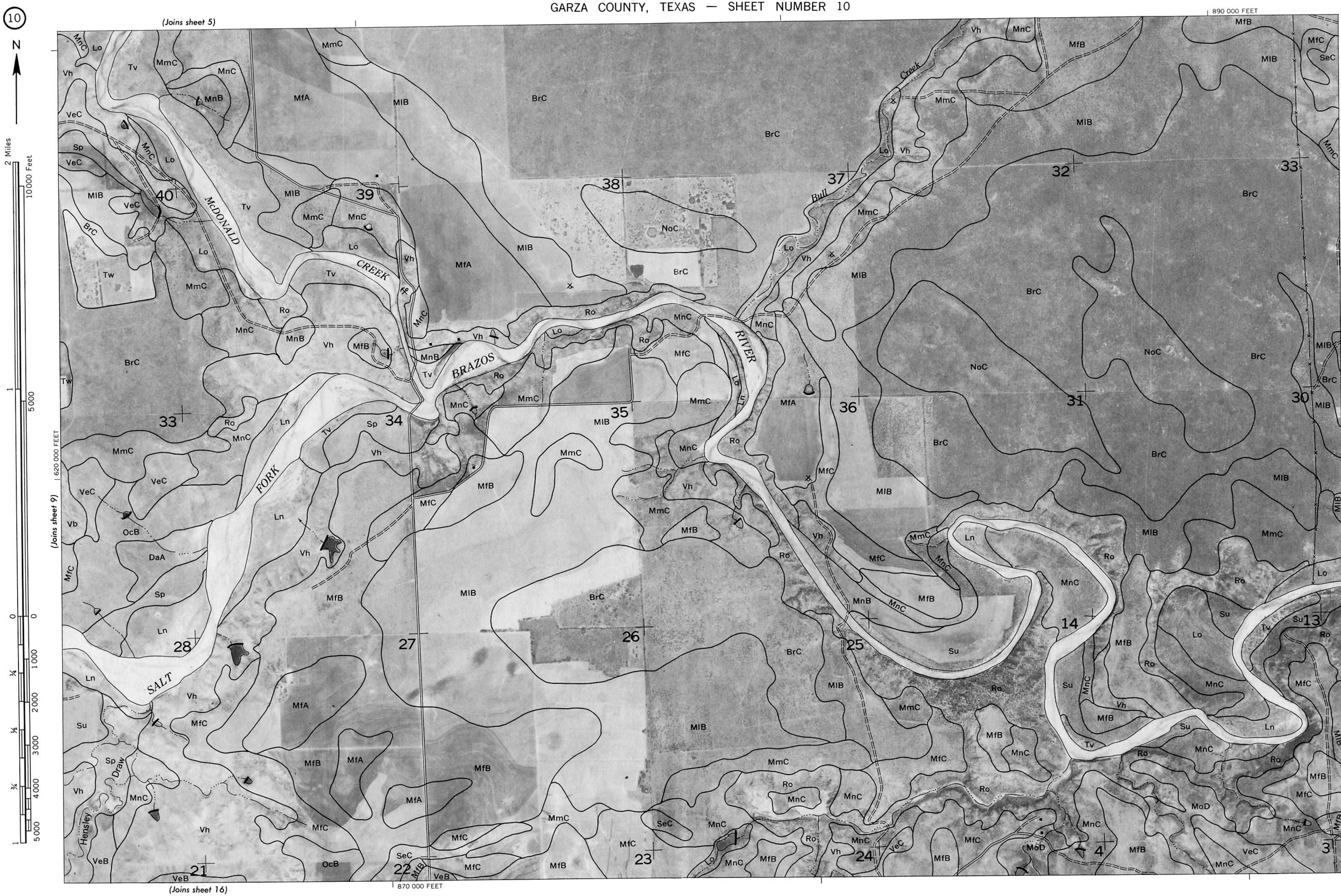
10

GARZA COUNTY, TEXAS — SHEET NUMBER 10



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12

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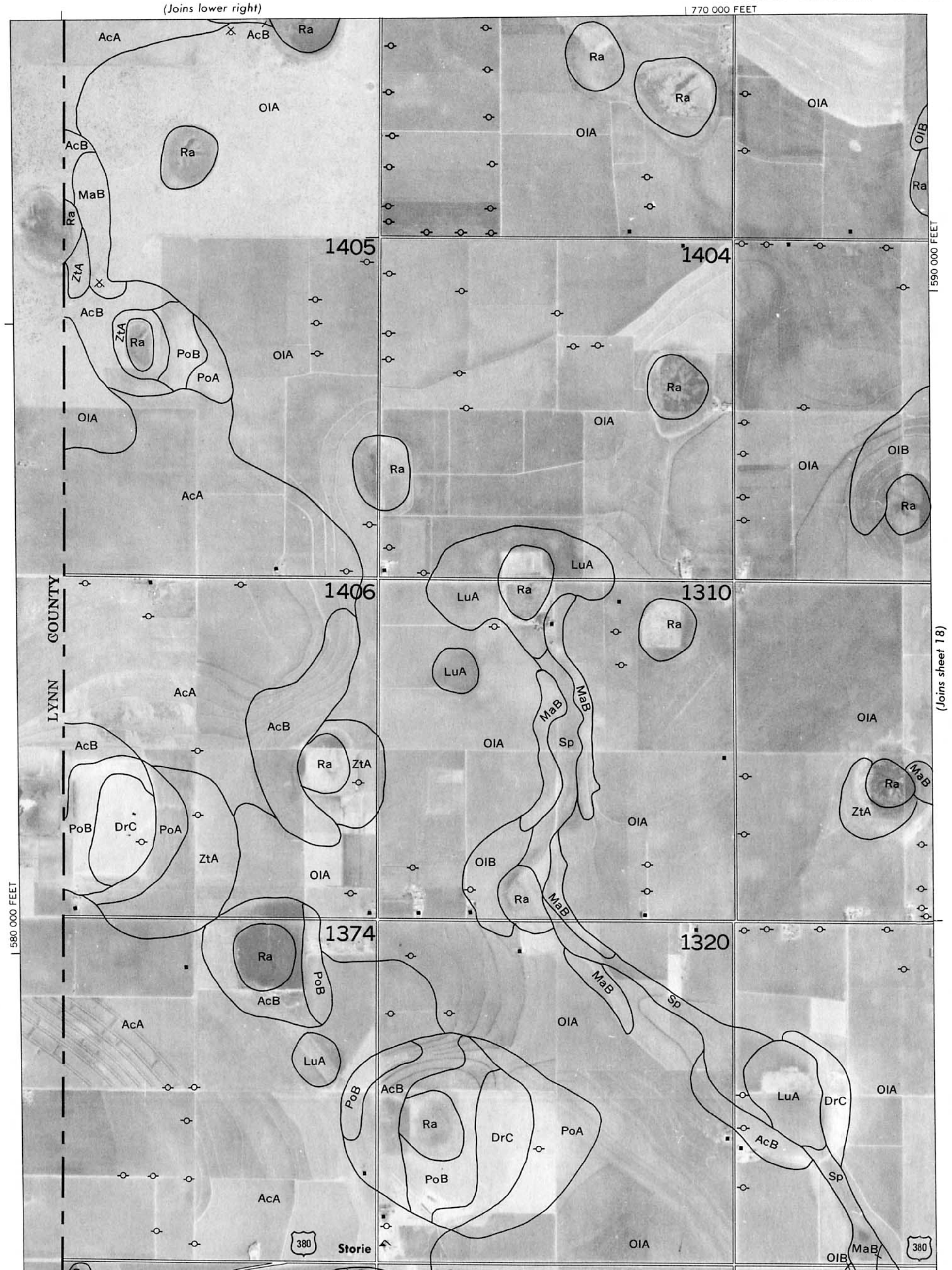

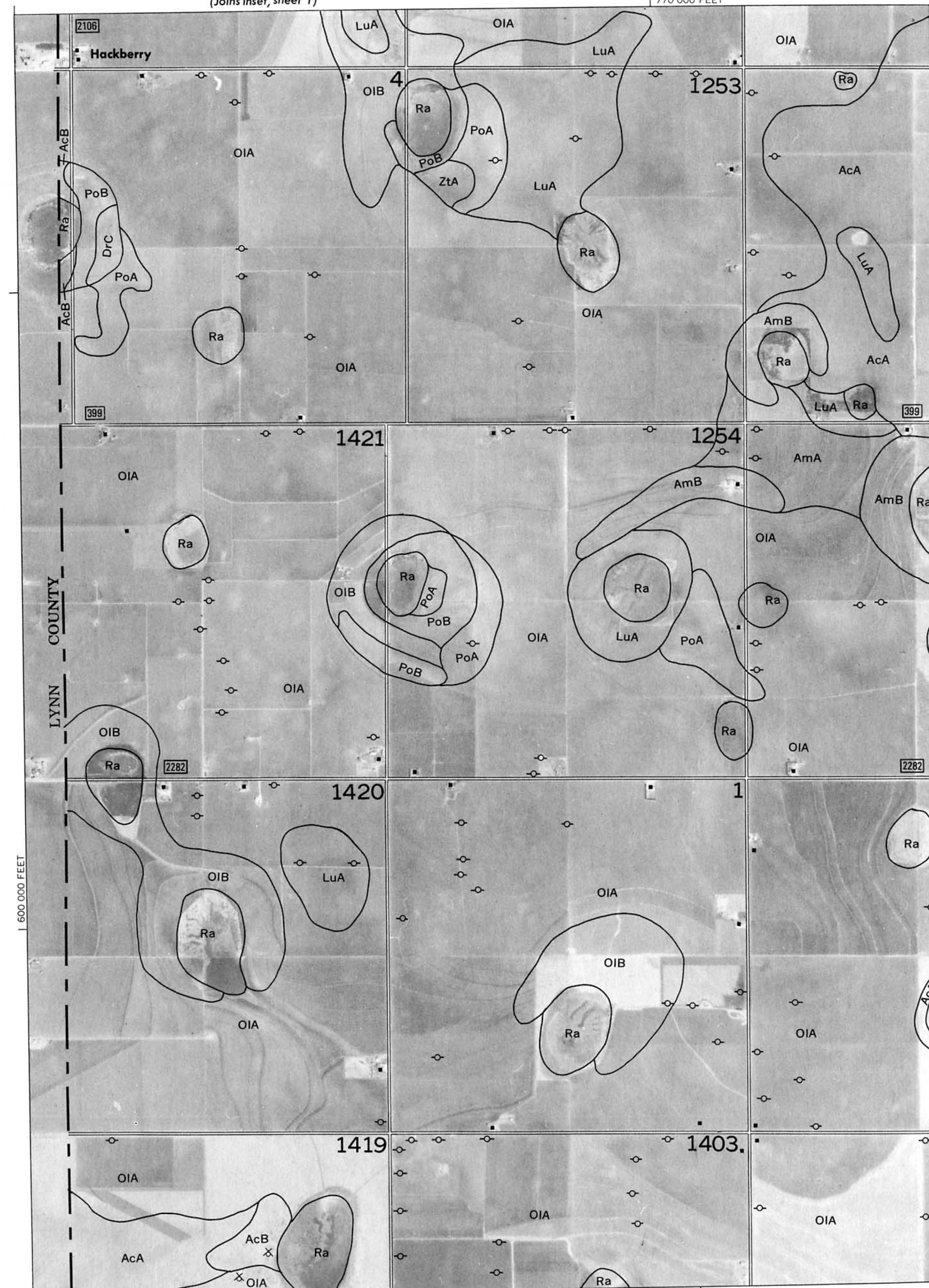

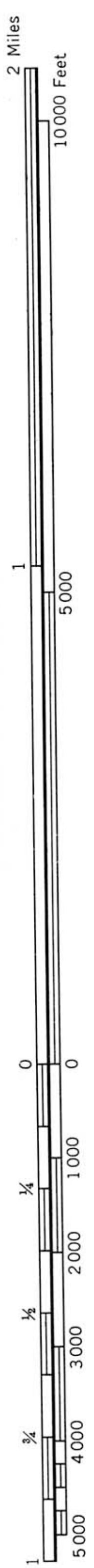

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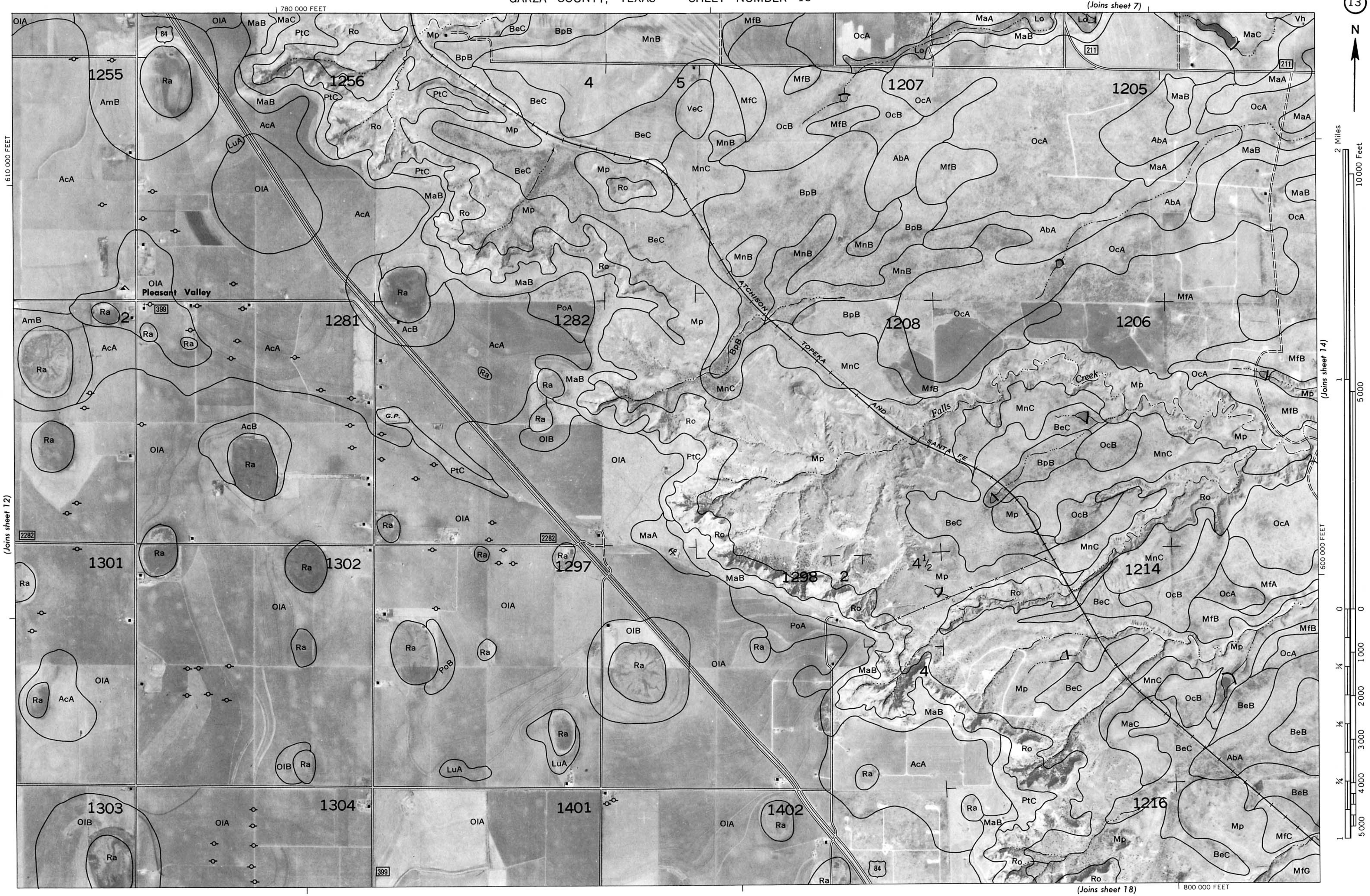

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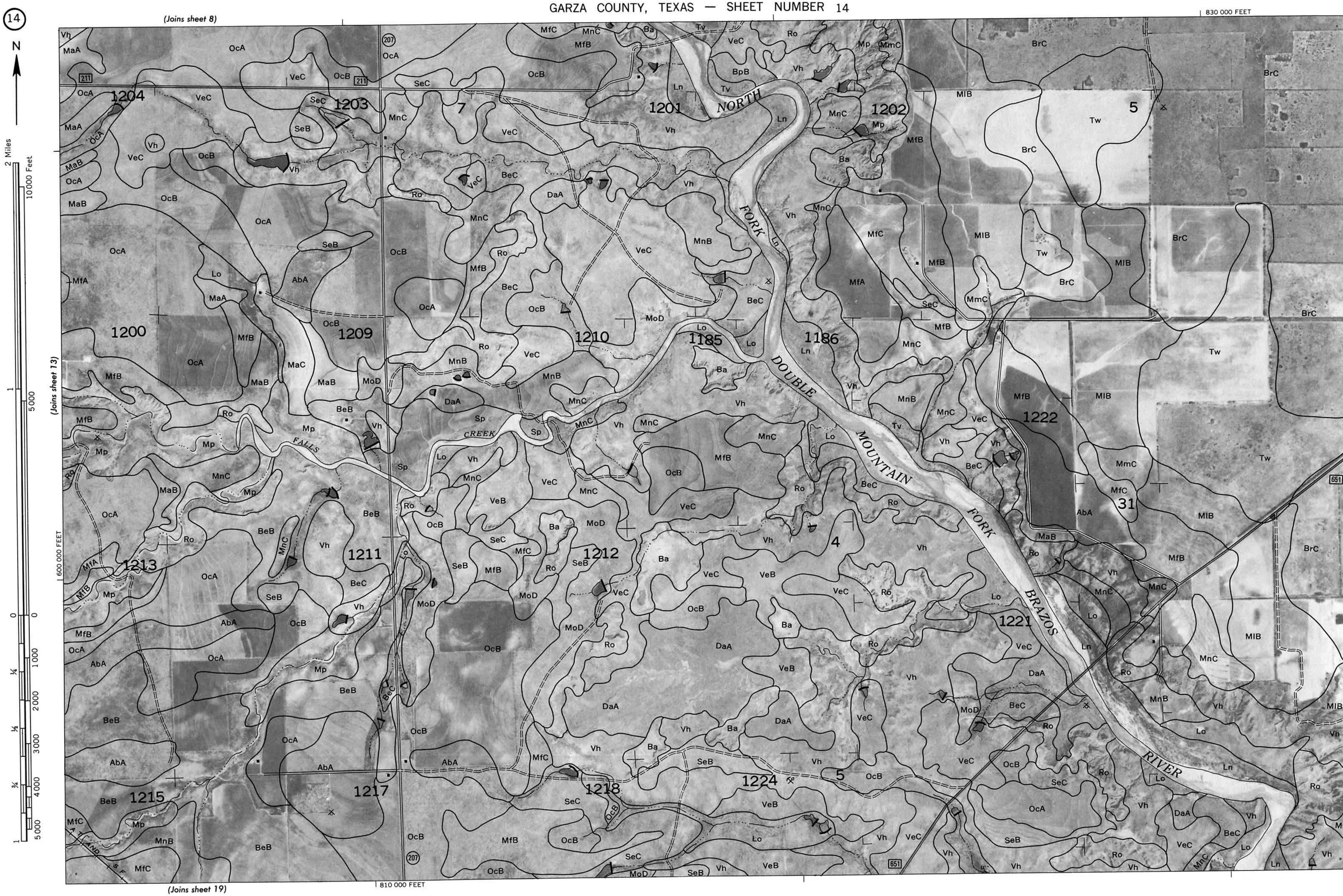

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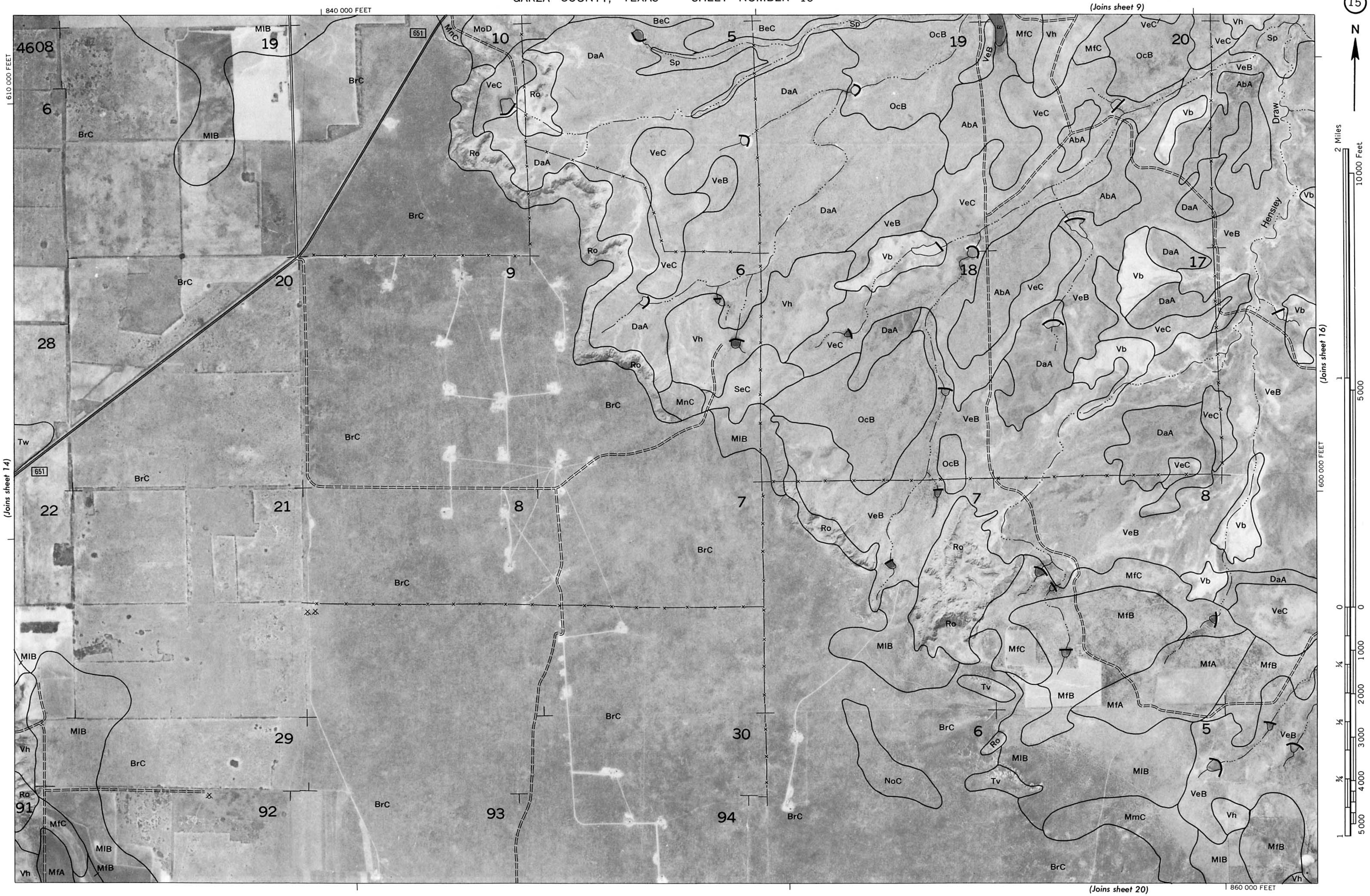

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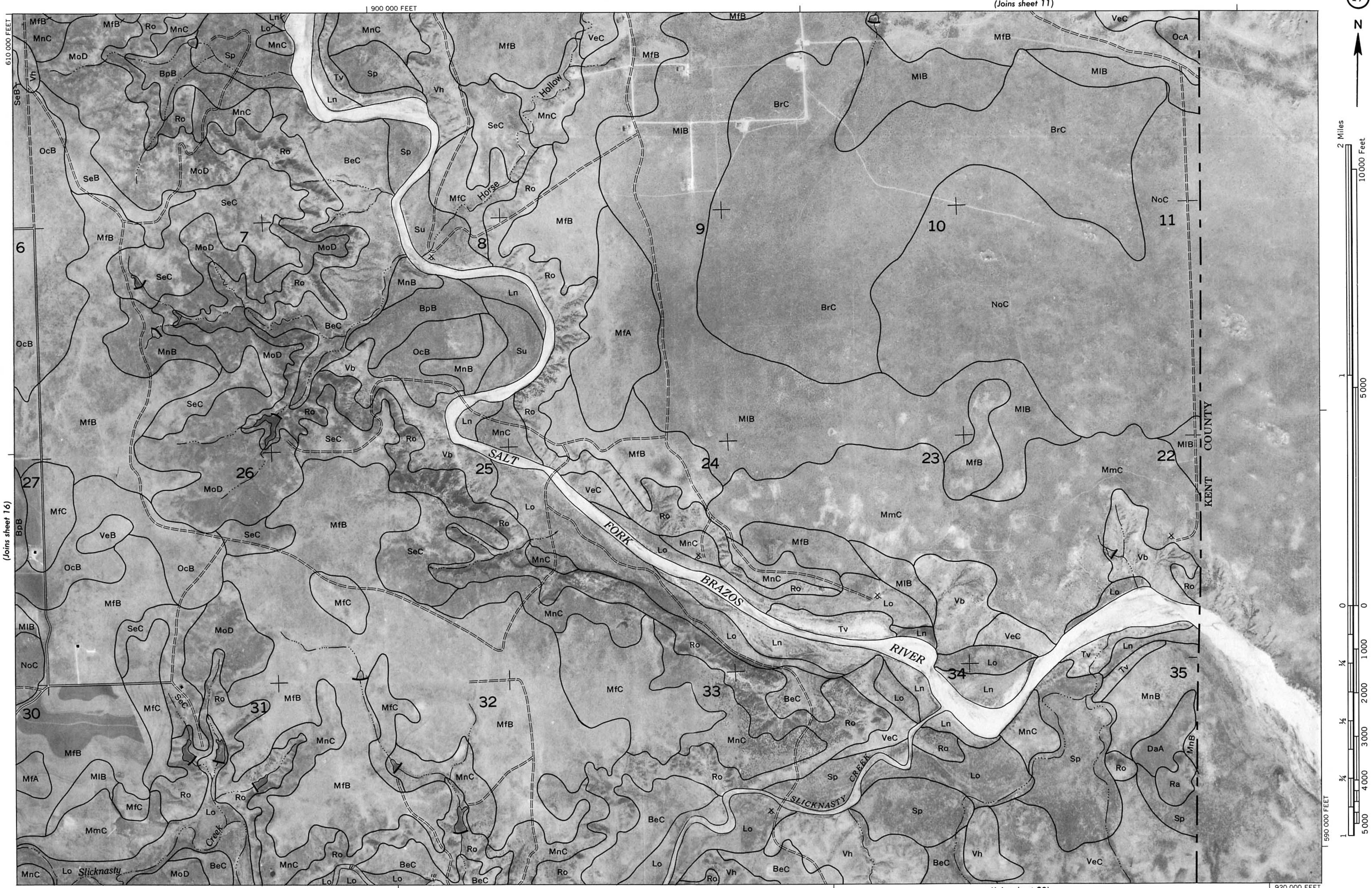

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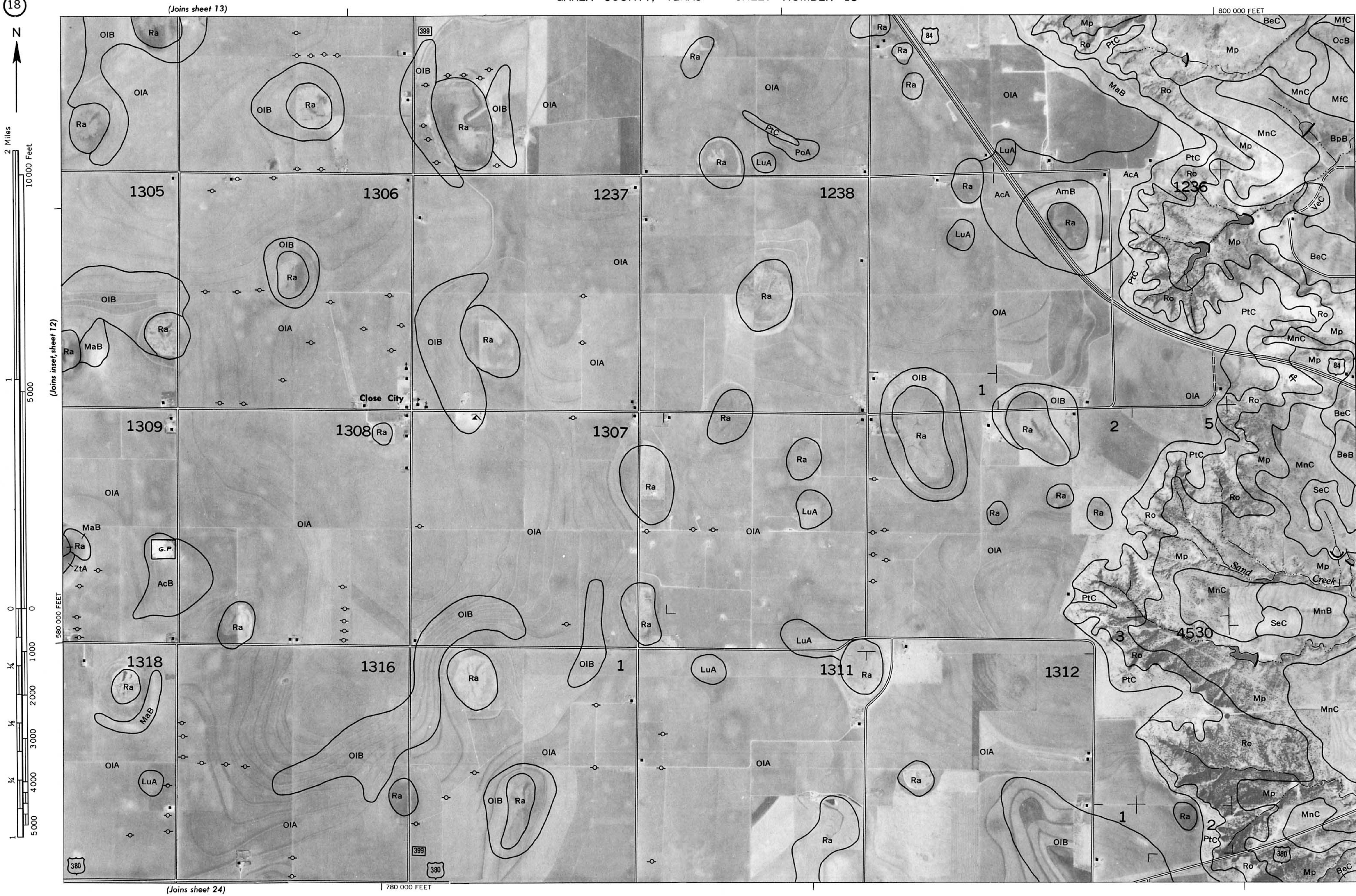

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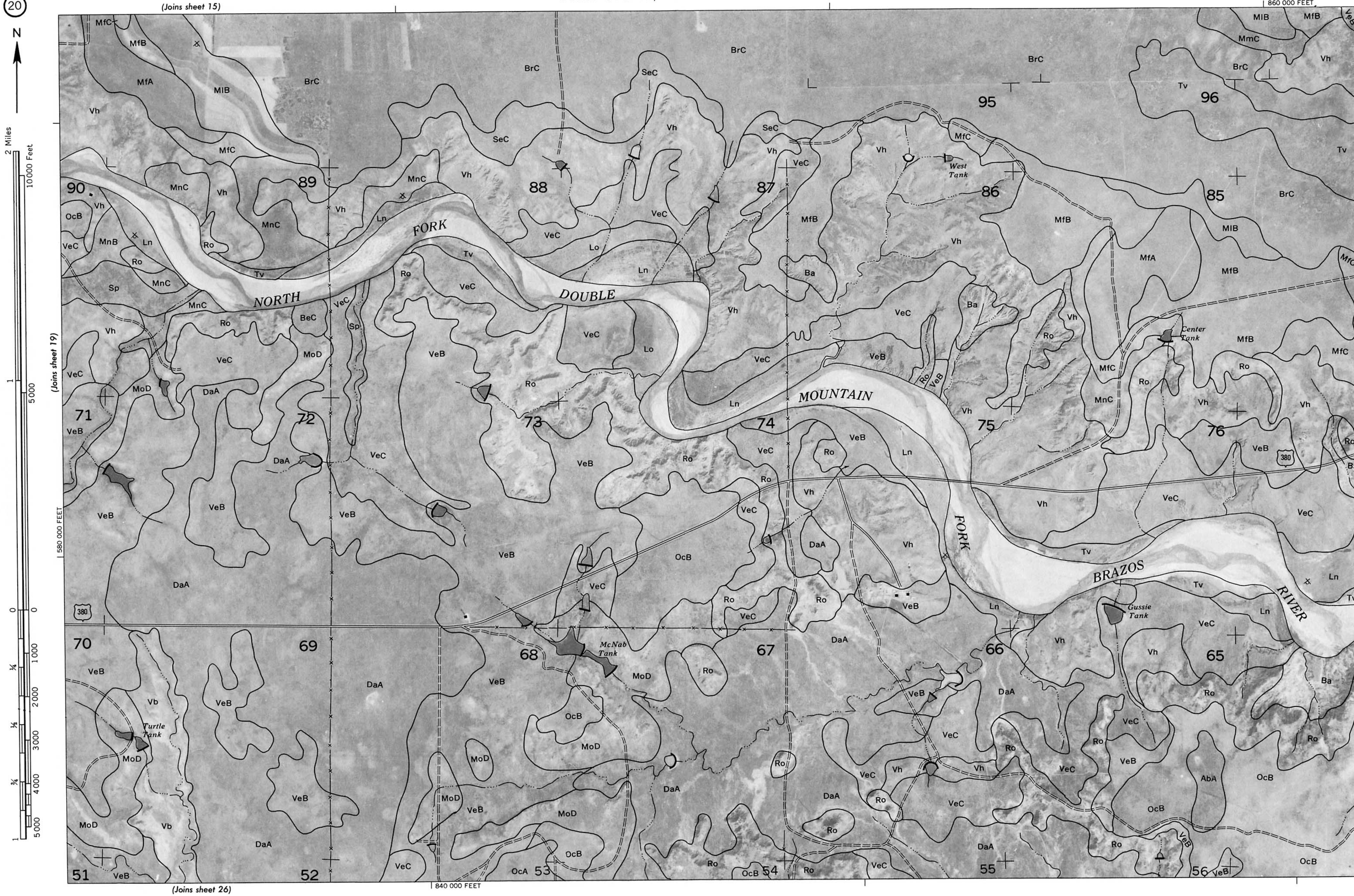

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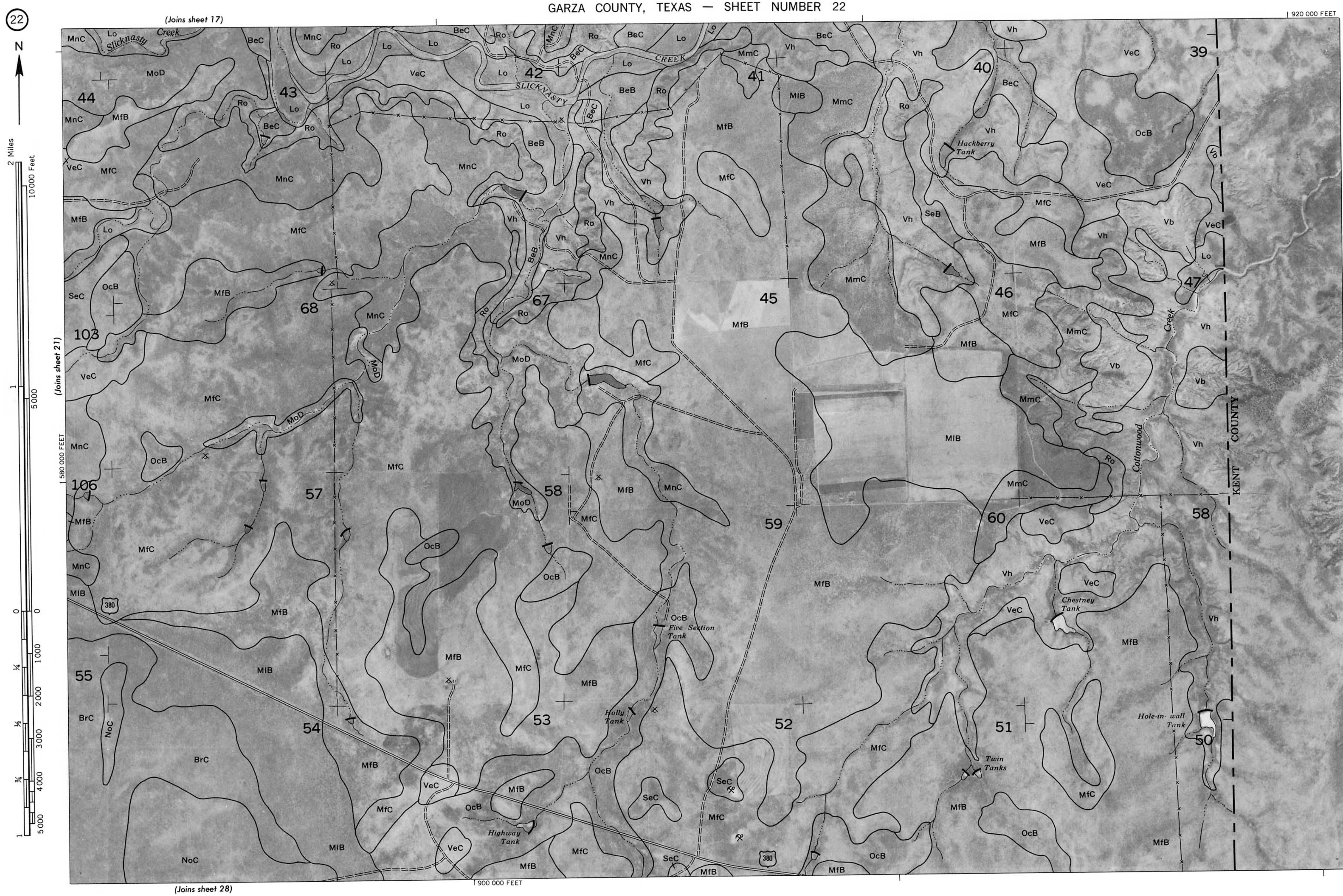

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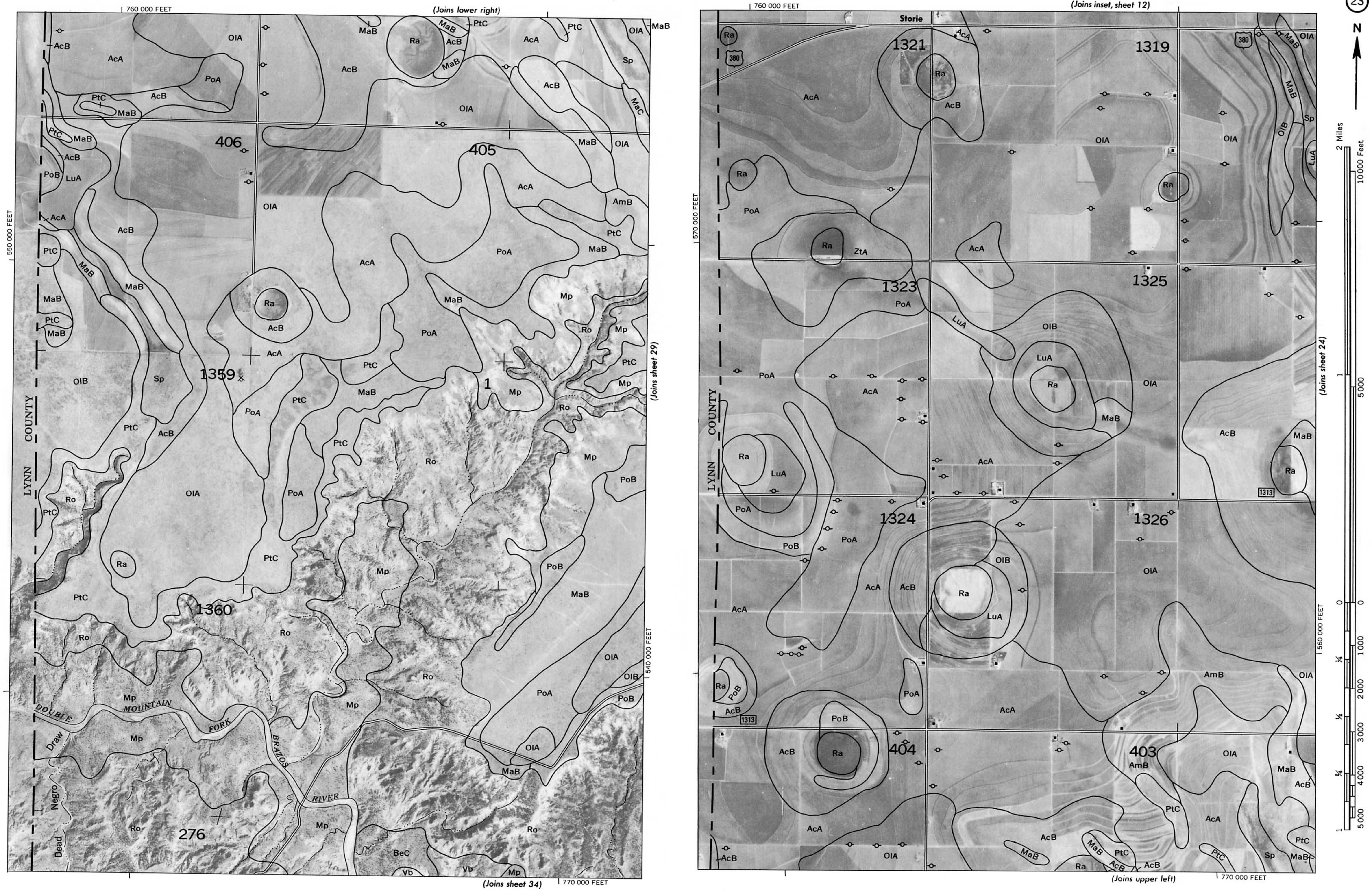

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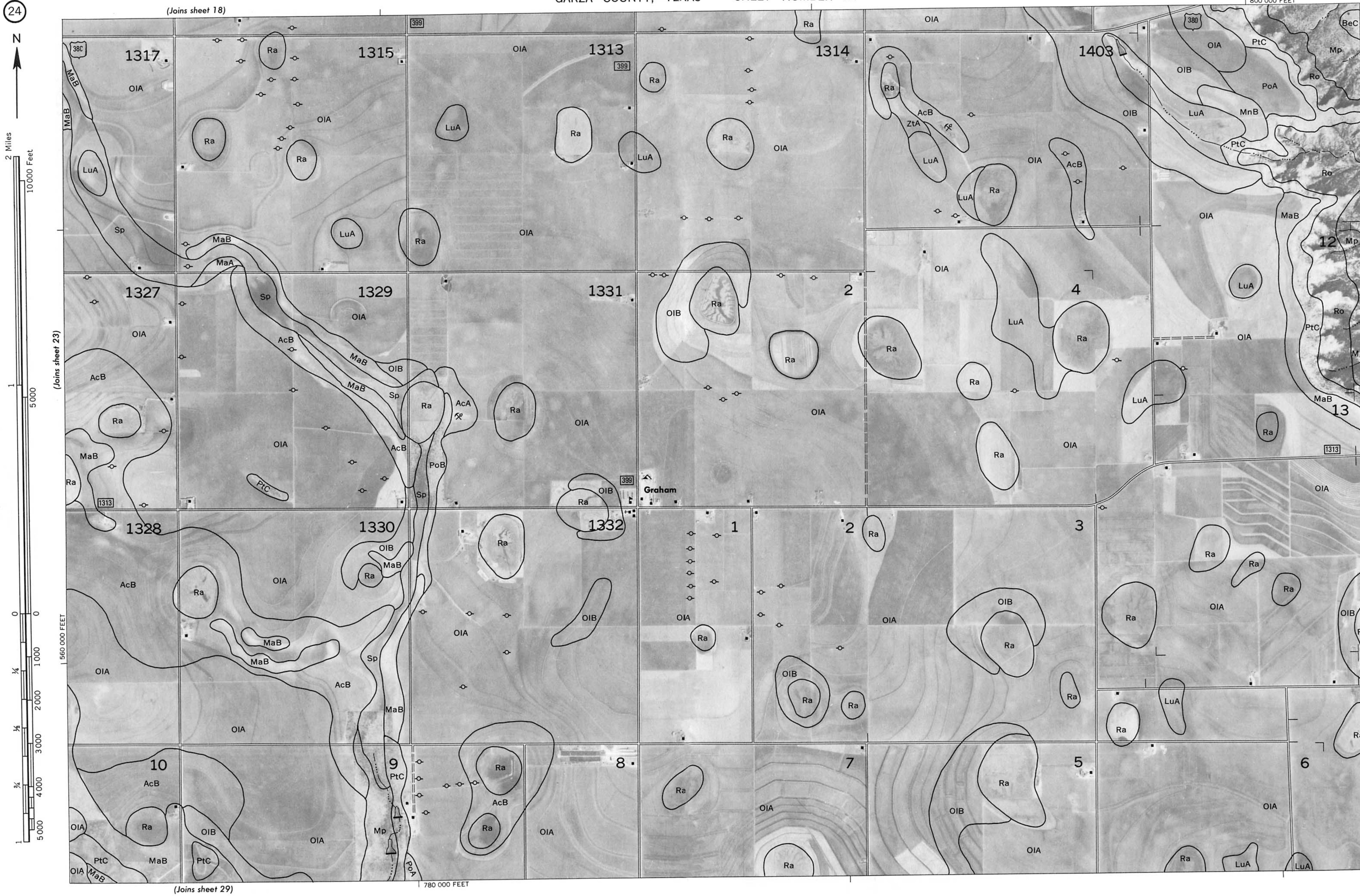

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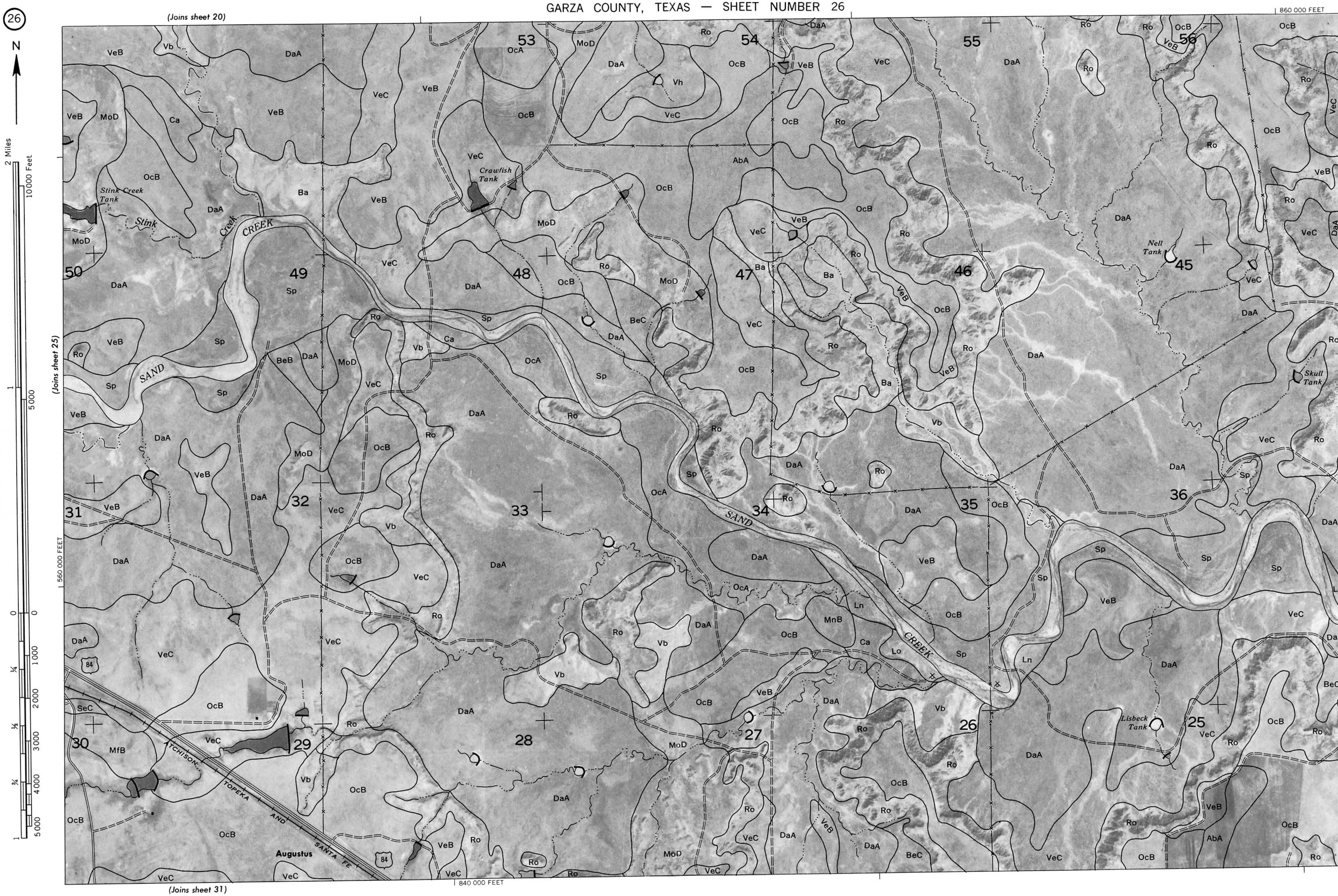

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Land division corners are approximately positioned on this map.

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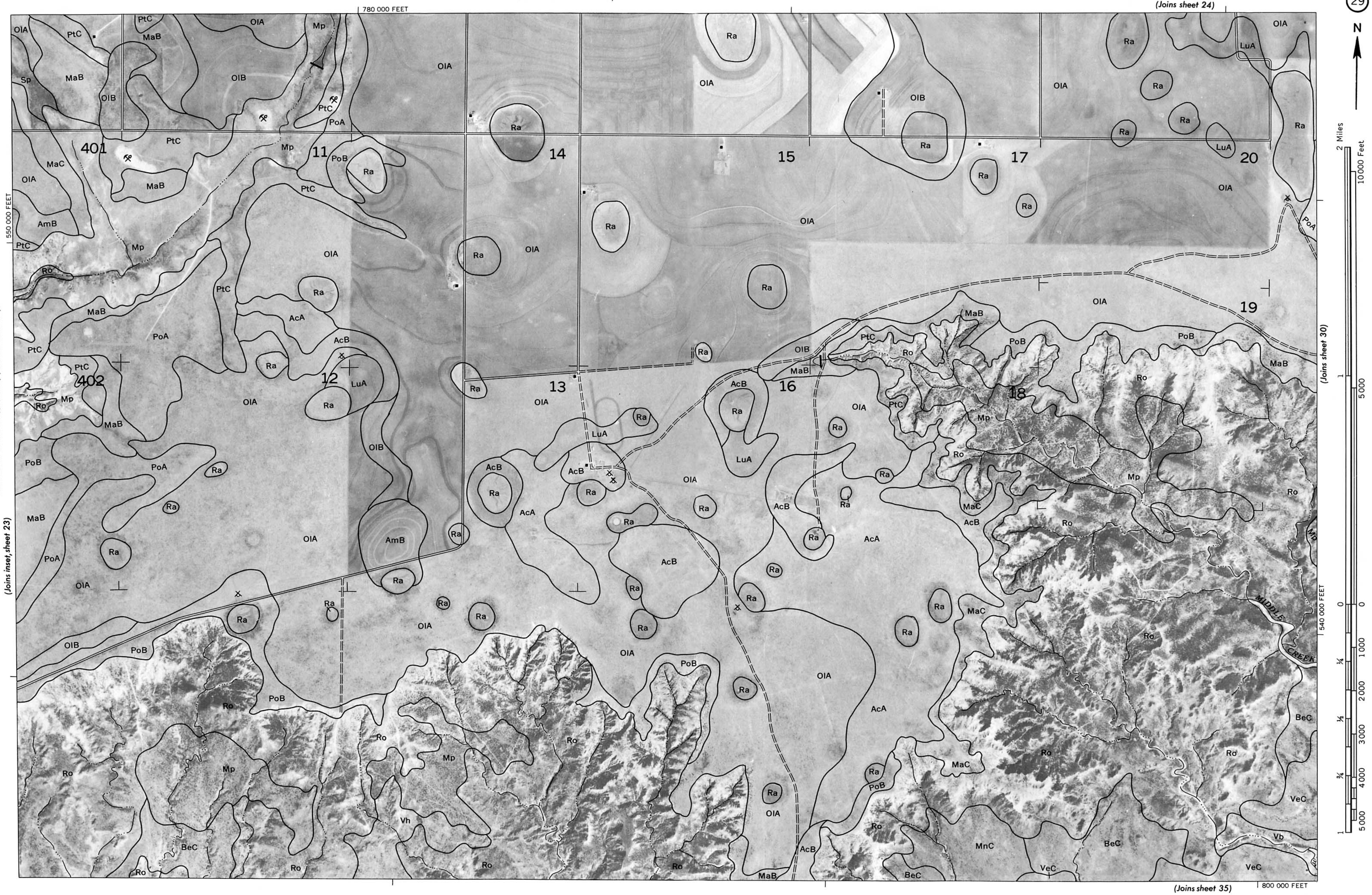

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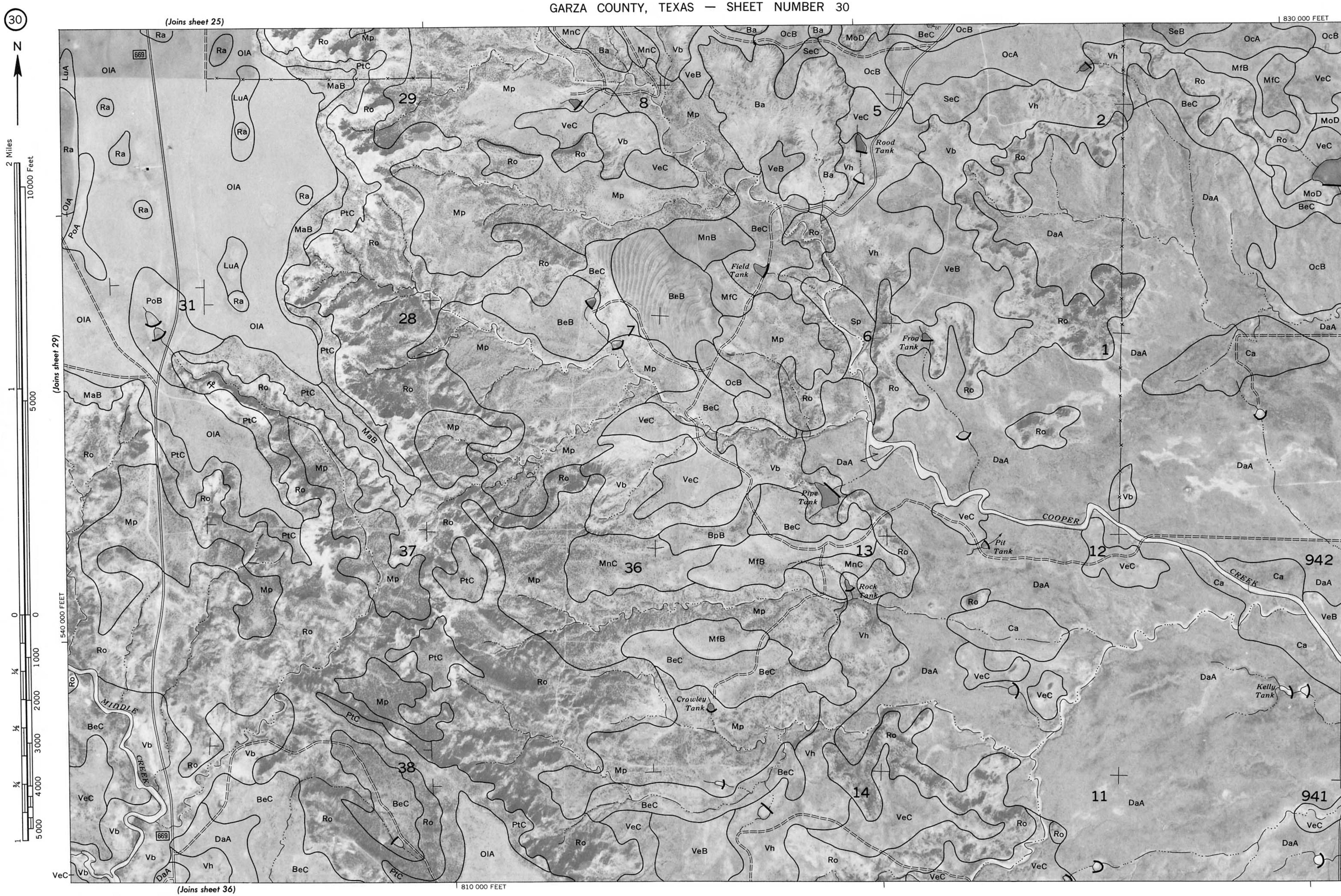

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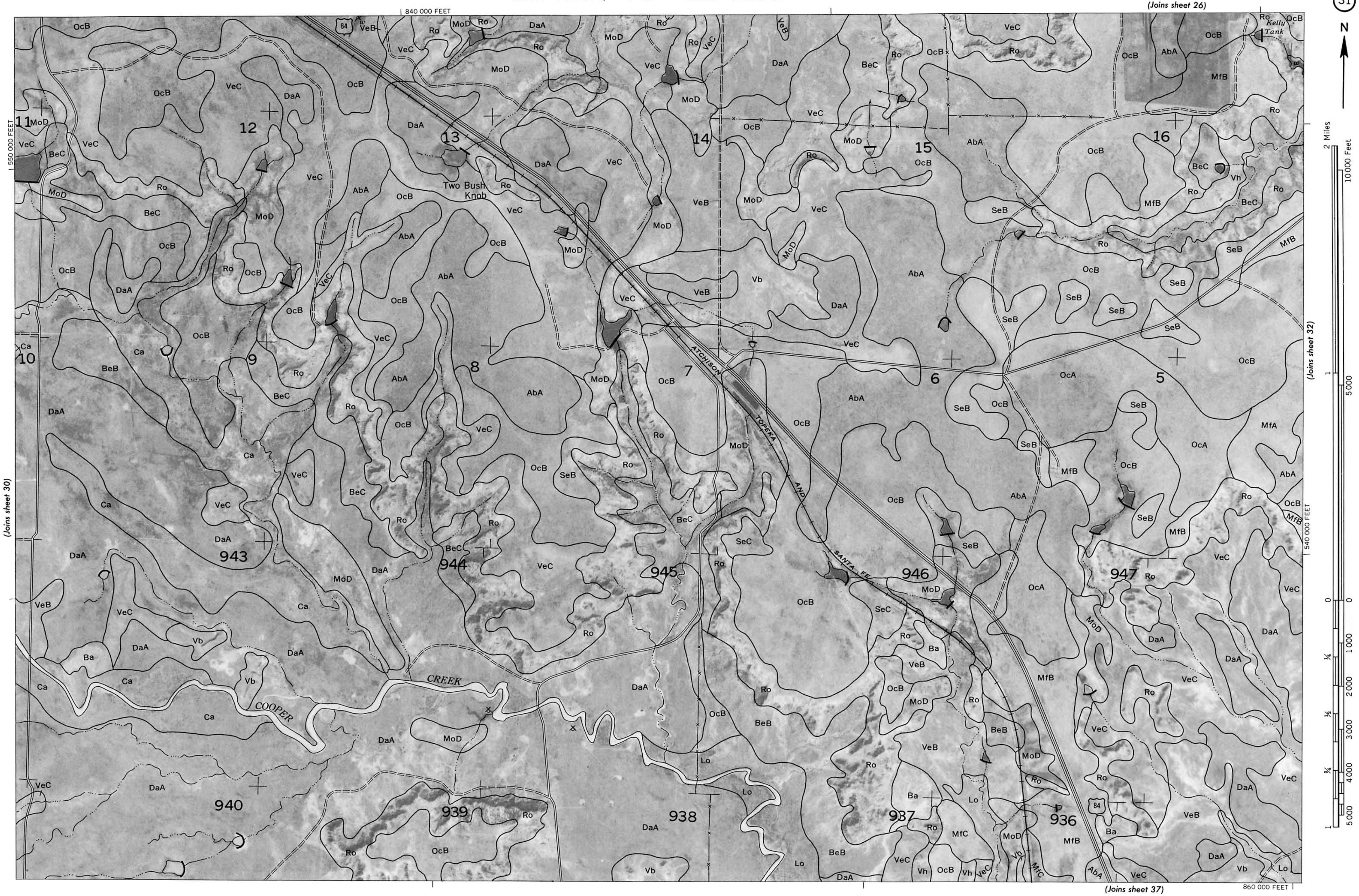

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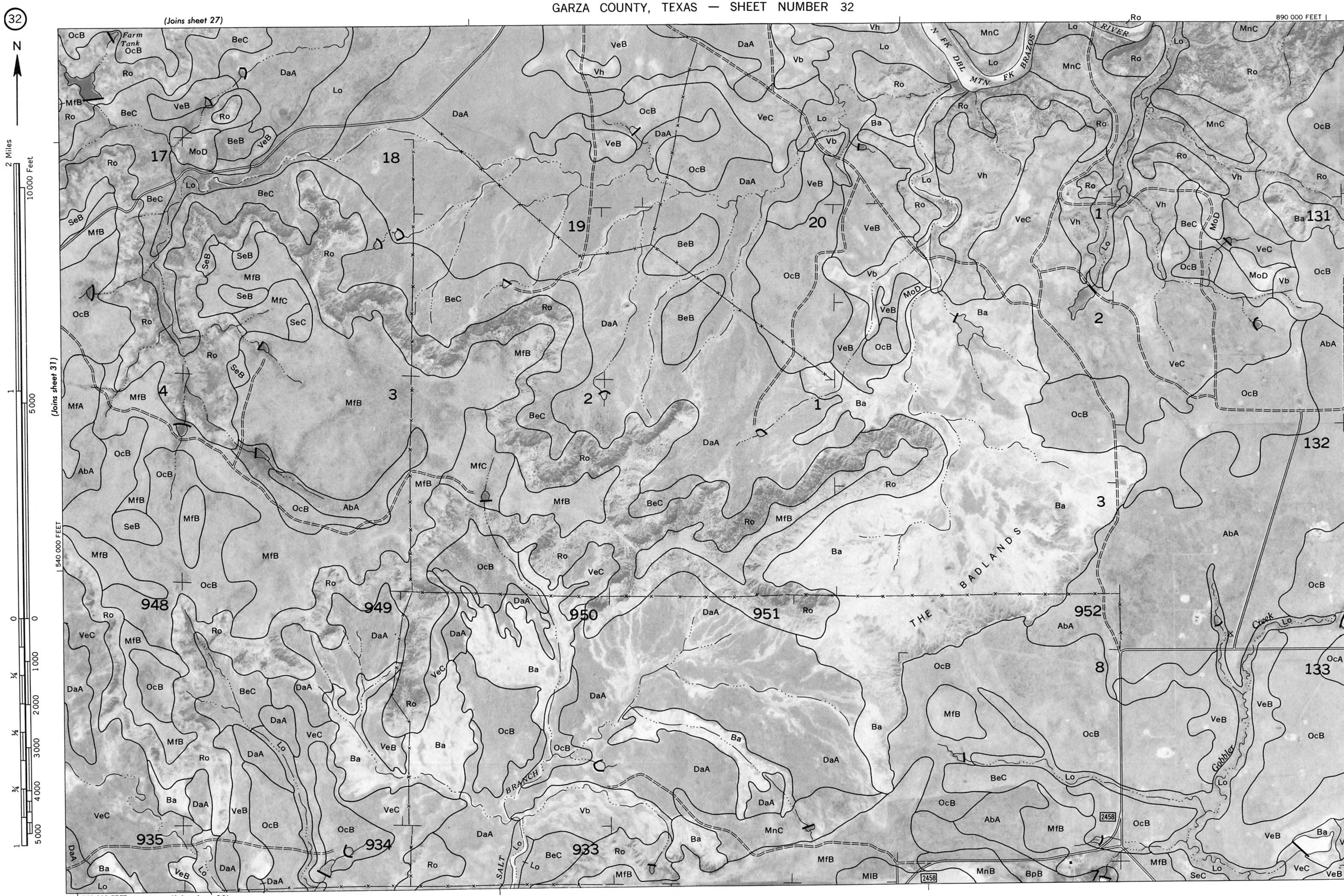

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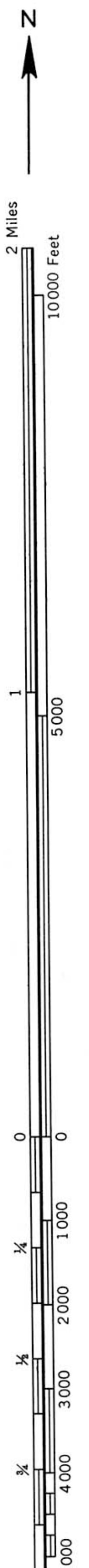

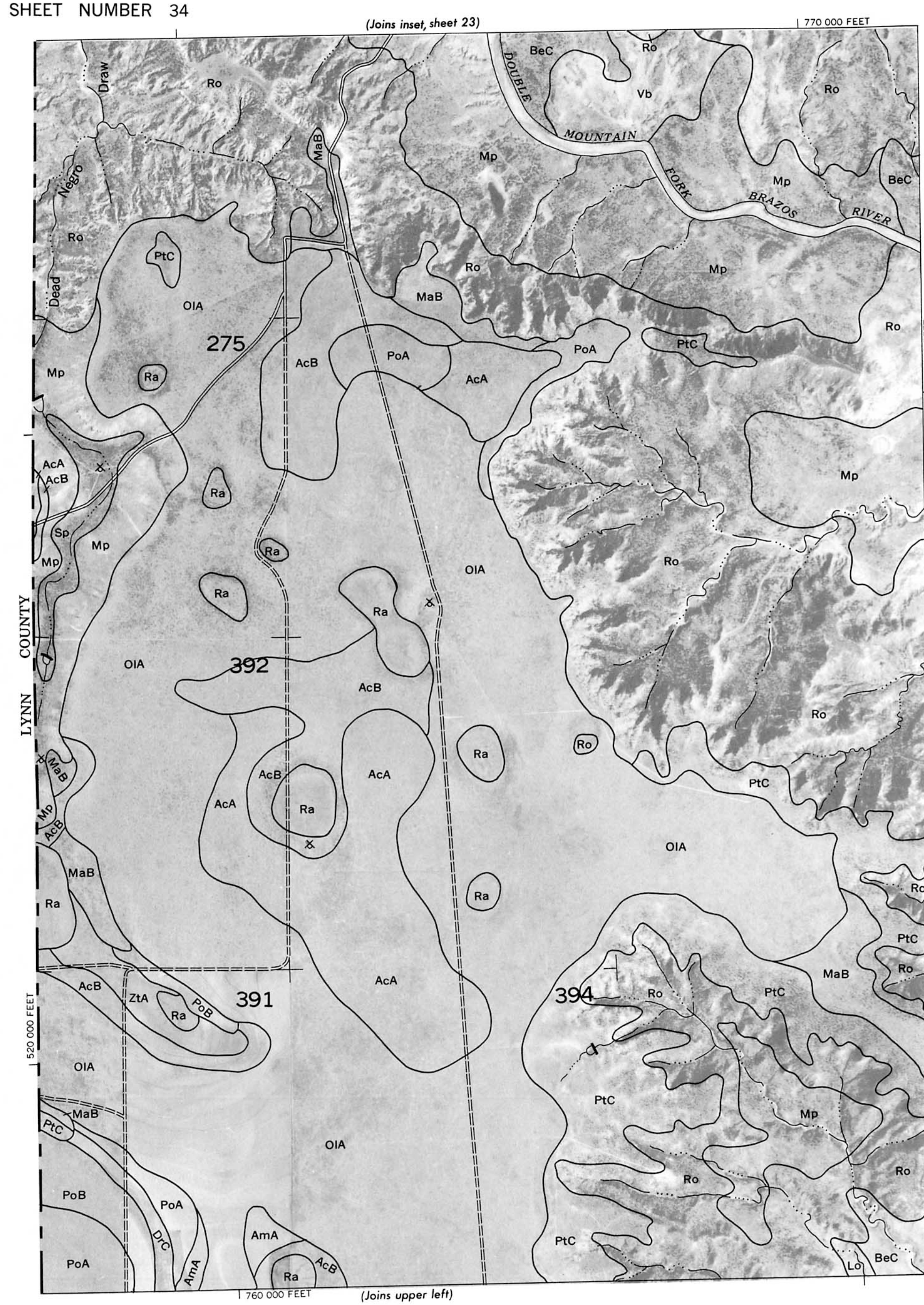

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GARZA COUNTY, TEXAS — SHEET NUMBER 35

35

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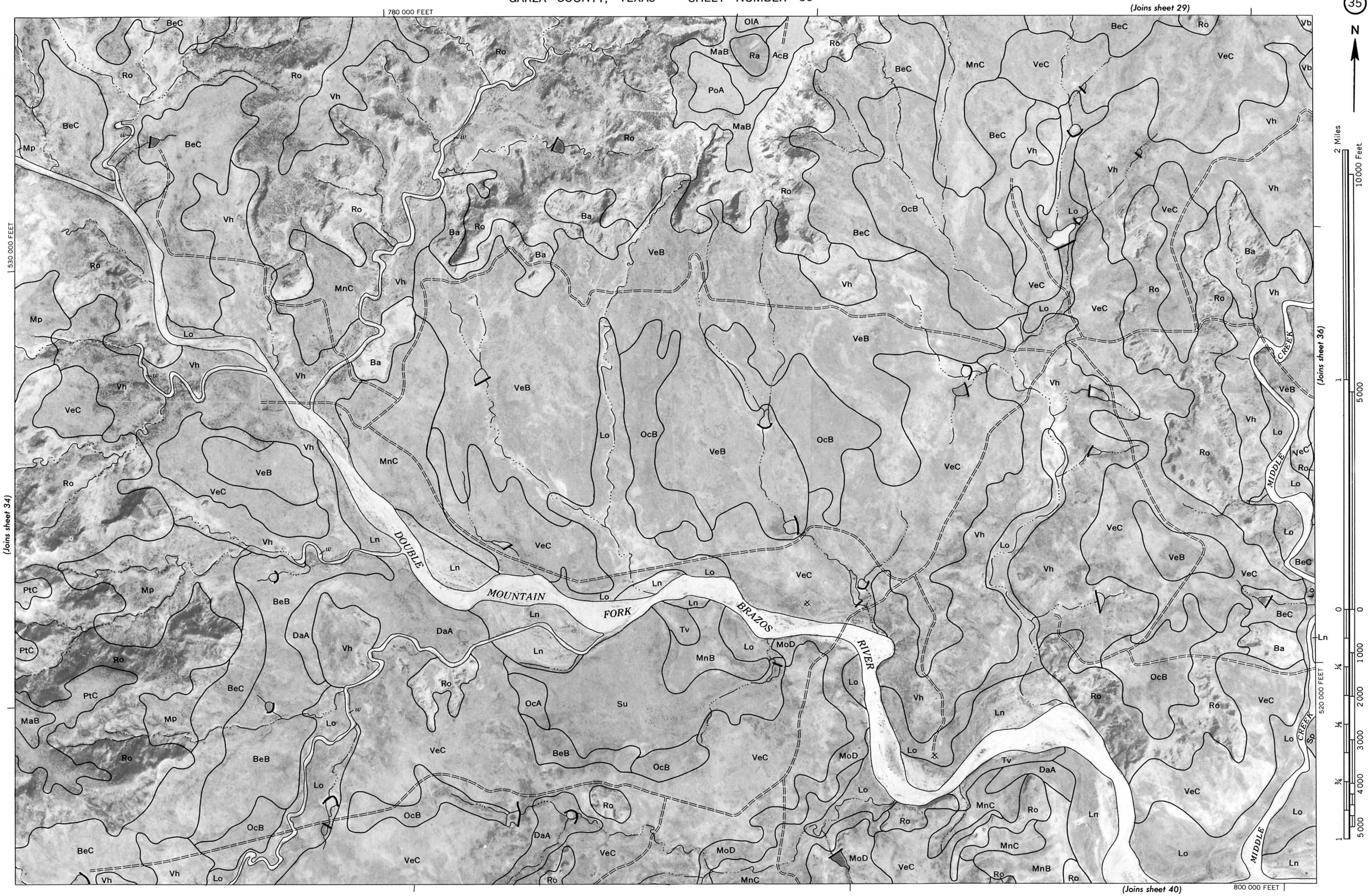

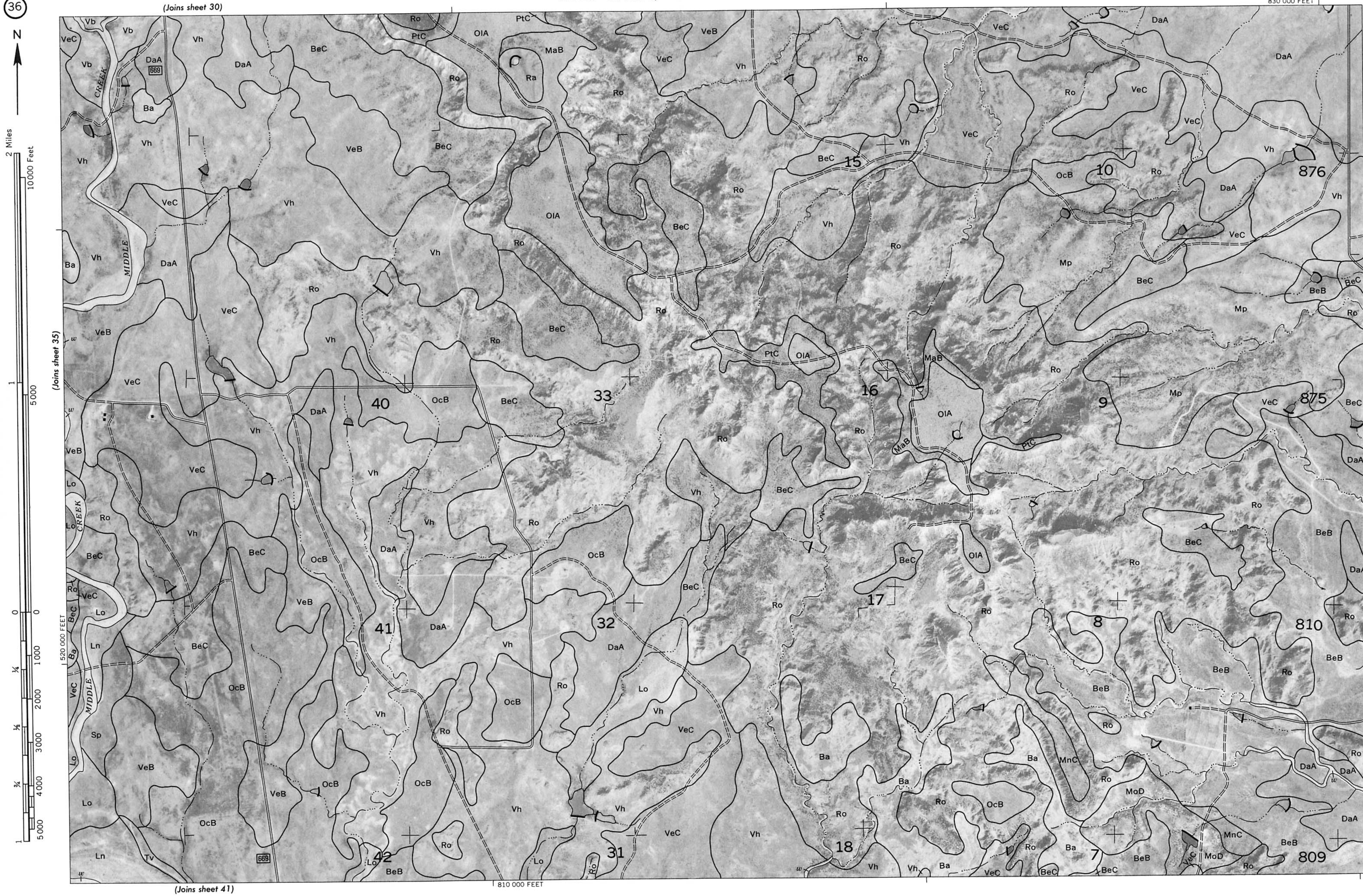

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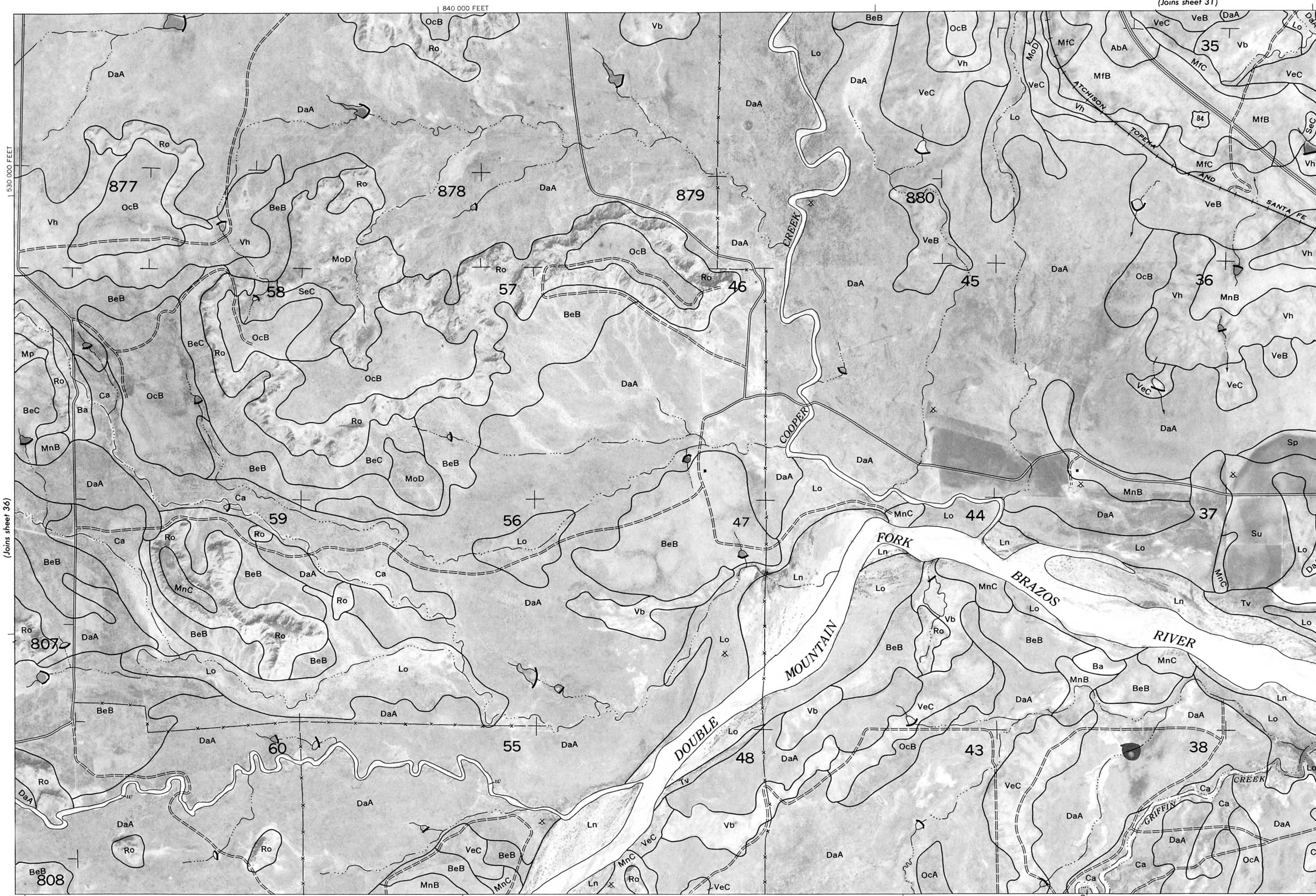
GARZA COUNTY, TEXAS — SHEET NUMBER 37

37

(Joins sheet 31)



(Joins sheet 38)

(Joins sheet 36)

(Joins sheet 42)

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2 Miles | 10000 Feet | 1 | 5000 | 0 | 0 | 1/4 | 1000 | 2000 | 1/2 | 3000 | 3/4 | 4000 | 1 | 5000

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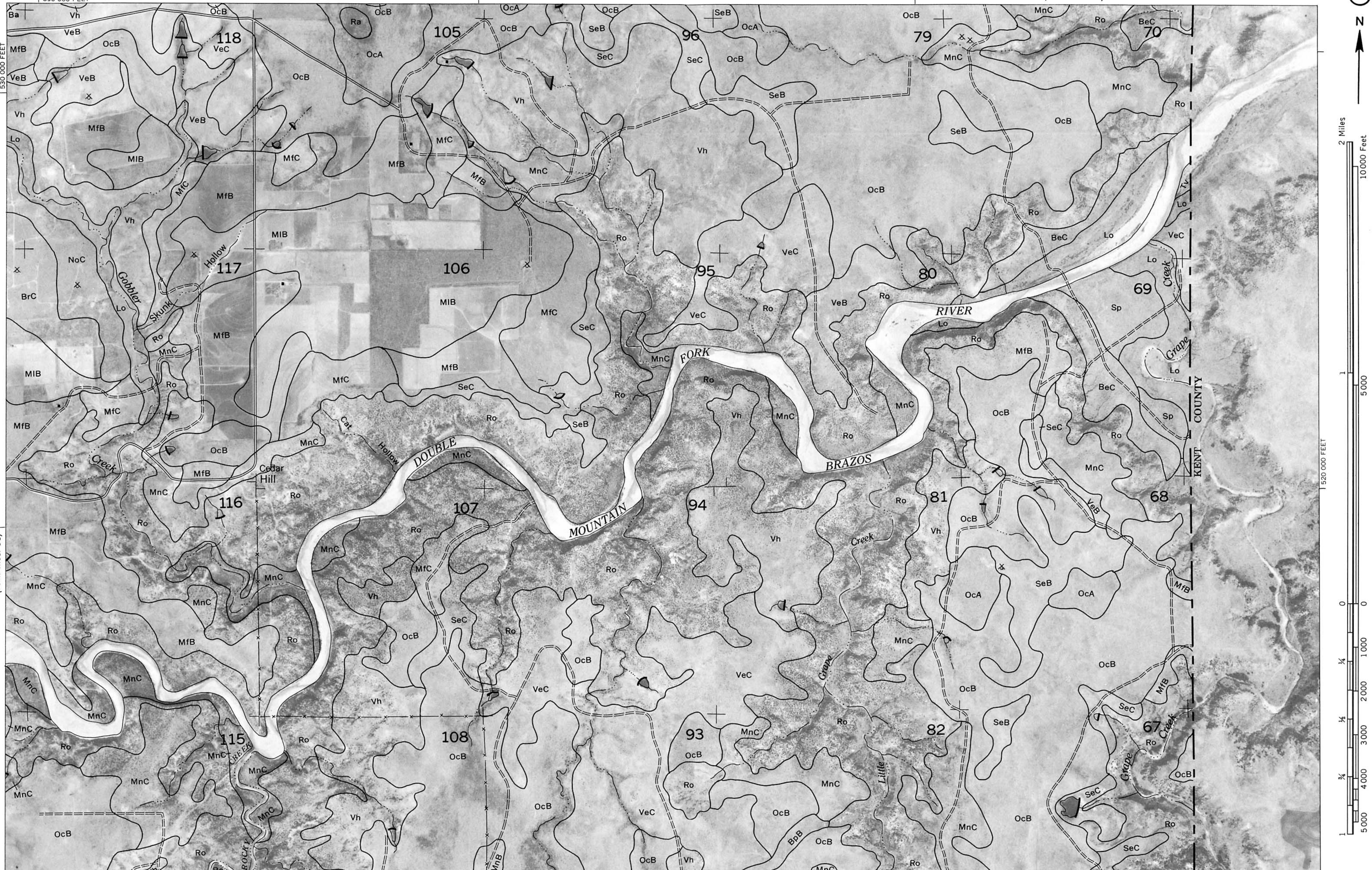
(Joins sheet 33)



(Joins sheet 38)

(Joins sheet 44)

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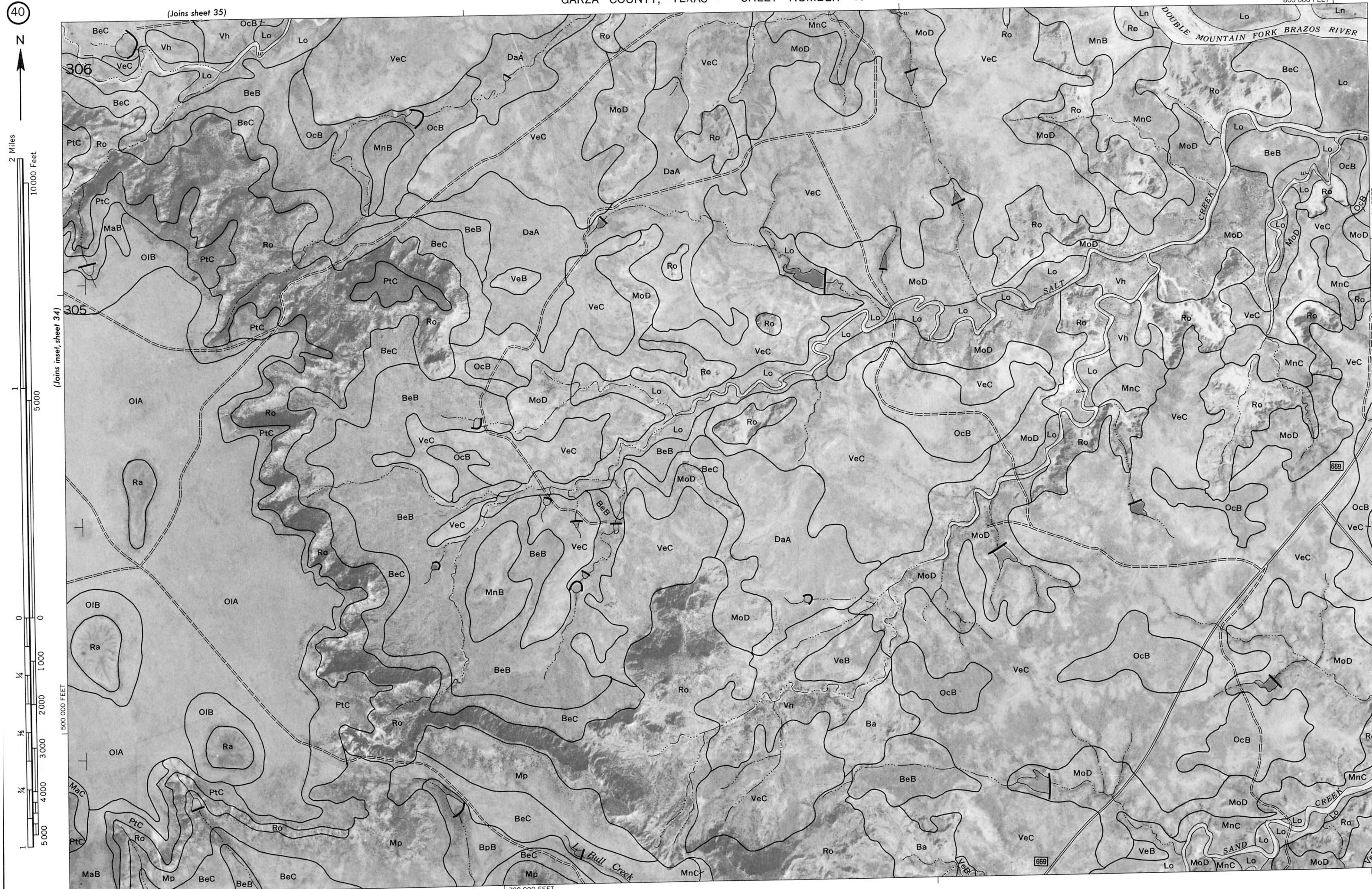
GARZA COUNTY, TEXAS — SHEET NUMBER 40



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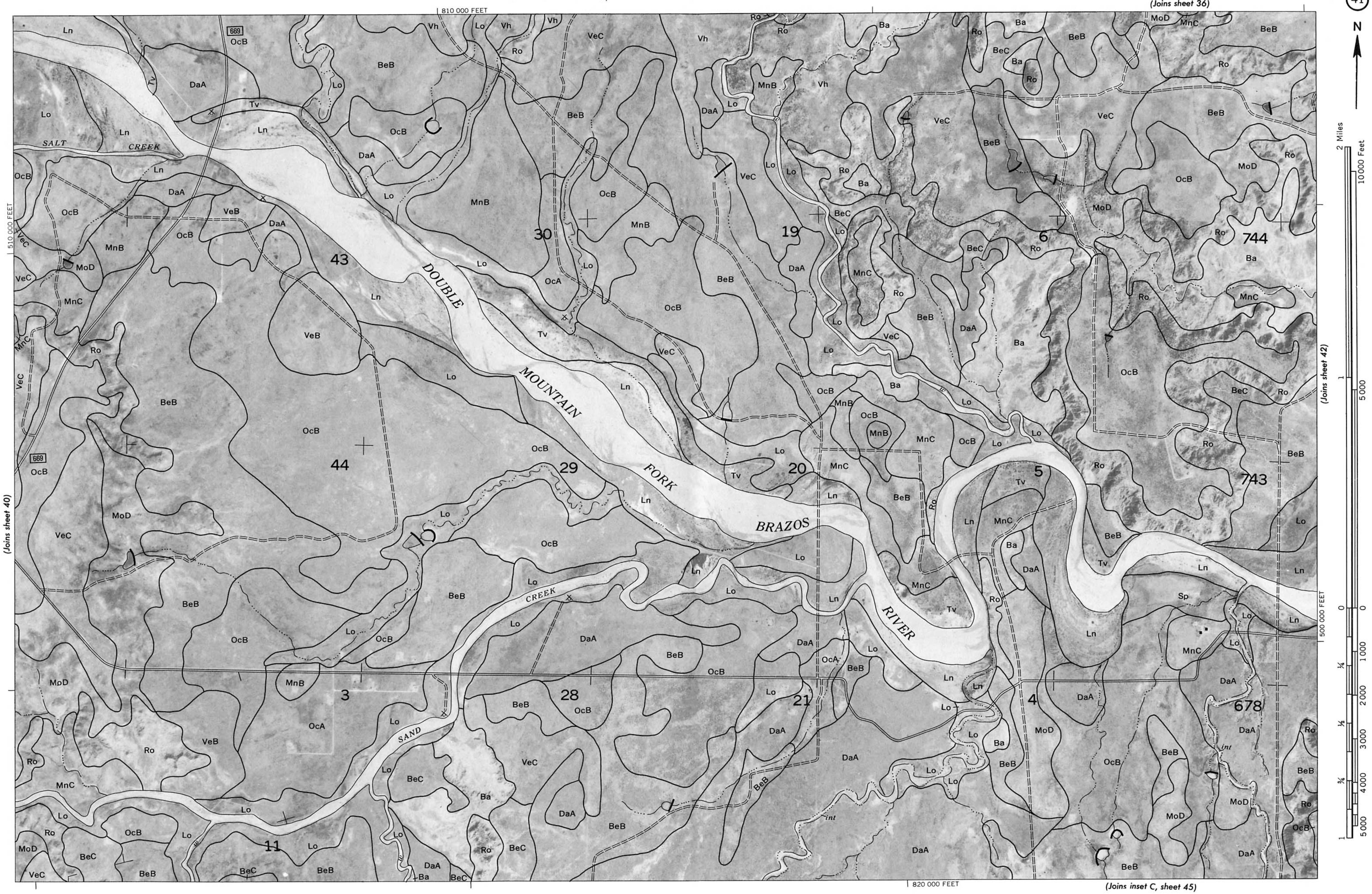

(Joins sheet 36)
(Joins sheet 42)
(Joins sheet 40)
(Joins inset C, sheet 45)
810 000 FEET
820 000 FEET
510 000 FEET
500 000 FEET
N
2 Miles
1
0
10000 Feet
5000
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1000
2000
3000
4000
5000
¼
½
¾
DOUBLE
MOUNTAIN
FORK
BRAZOS
RIVER
SALT
CREEK
SAND
CREEK
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19
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29
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5
743
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678
11
int

GARZA COUNTY, TEXAS — SHEET NUMBER 42

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Photobase from 1972 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Texas coordinate system, north central zone.

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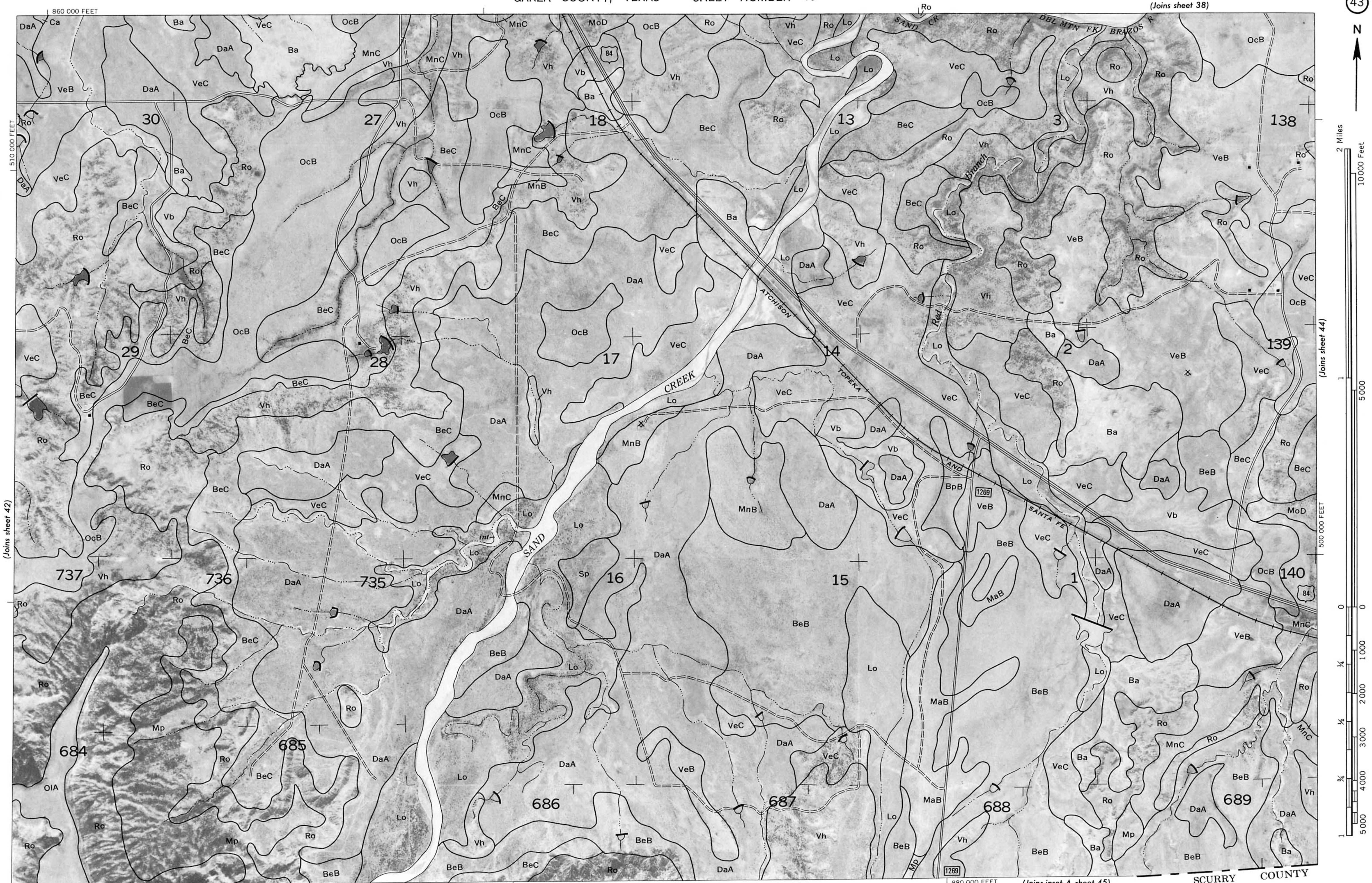

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GARZA COUNTY, TEXAS — SHEET NUMBER 44

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